SN. 256

COUNTER/TIMER

INSTRUCTION MANUAL

FILE COPY

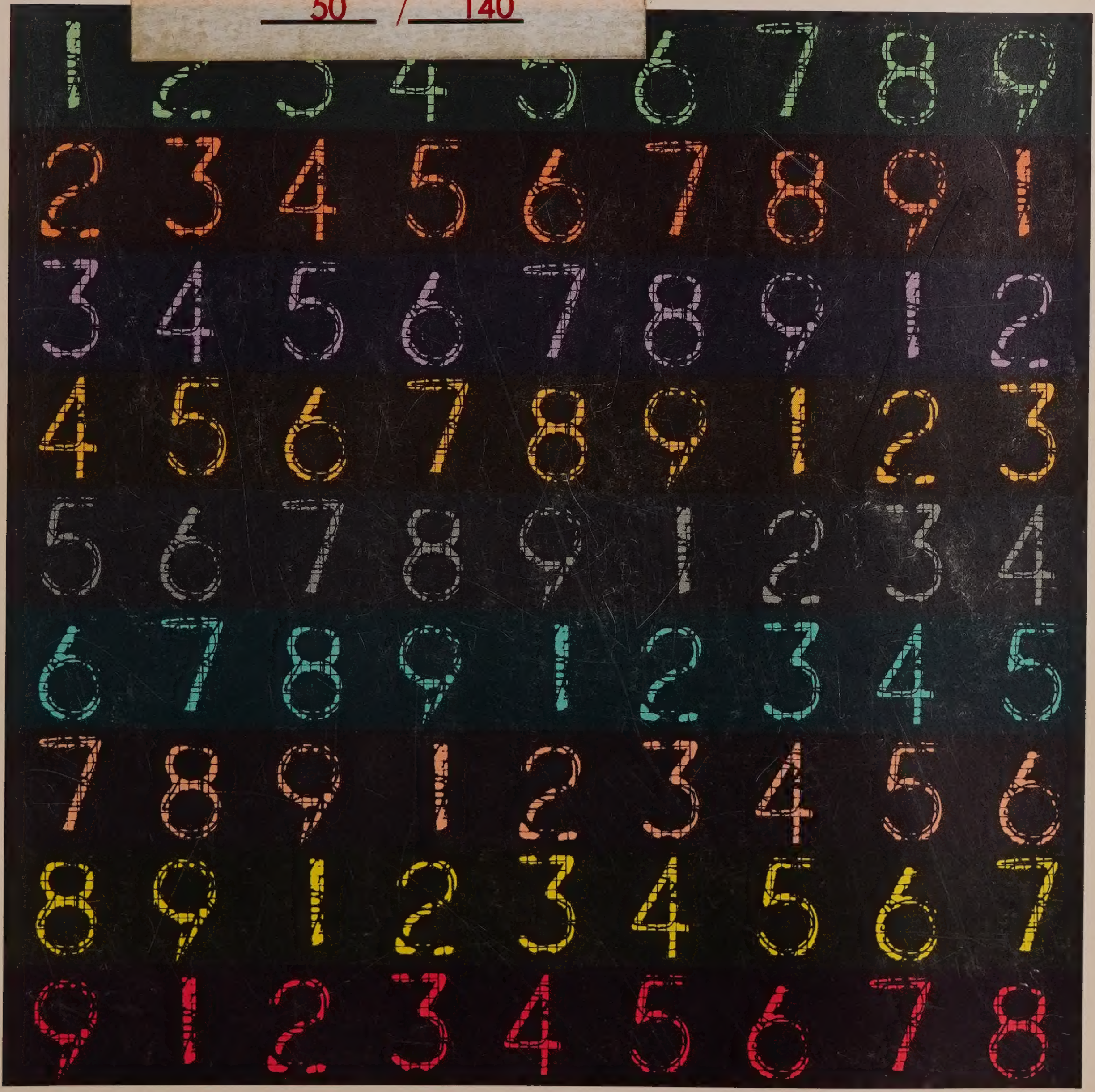
Pre-Production Eng.

INSTRUMENT CONTROL

Please Return

50 / 140

SD 7015
500 MHz Counter



SYSTRON-DONNER CORPORATION • 888 GALINDO STREET • CONCORD, CALIFORNIA 94520 • PHONE: (415) 682-6161 • TWX: 910-481-9478
IN EUROPE: SYSTRON-DONNER INTERNATIONAL, S. A. • 447 AVE. DE TERVUEREN • BRUXELLES 15, BELGIUM • R.C.B. 340.938

Digitized by the Internet Archive
in 2026

https://archive.org/details/manualsplus_13100

SD 7015

This manual is intended to aid in the operation and maintenance of Systron-Donner Corporation equipment, and is not to be used otherwise or reproduced in whole or in part without the written consent of *SYSTRON-DONNER CORPORATION*.

SYSTRON-DONNER CORPORATION
888 Galindo Street
Concord, California 94520

TABLE OF CONTENTS

PAGE

CHAPTER 1 - GENERAL DESCRIPTION

1.1 Basic Functions 1-1
1.2 Standard Features 1-1
1.3 Applications 1-2
1.4 Optional Features 1-2
1.5 Specifications 1-3
1.6 Recommended Test Equipment 1-6
1.7 Preparation For Reshipment 1-6

CHAPTER 2 - INSTALLATION

2.1 Installation Requirements 2-1
2.2 Inspection and Adjustment 2-1

CHAPTER 3 - OPERATION

3.1 Preparation for Use 3-1
3.2 Controls, Indicators, and Connectors 3-1
3.2.1 Gate Indicator 3-1
3.2.2 Gate Indicator 3-1
3.2.3 Function Switch 3-1
3.2.4 Readout Indicators 3-2
3.2.5 Input Attenuator 3-2
3.2.6 Trigger Level Control 3-2
3.2.7 Annunciator Assembly 3-2
3.2.8 AC-DC Switch 3-2
3.2.9 Input Connector 3-3
3.2.10 Reset Pushbotton 3-3
3.2.11 High Frequency Input 3-3
3.2.13 Range Switch 3-3
3.2.14 Storage On/Off Switch 3-3
3.2.15 Reset Connector 3-3
3.2.16 BCD Output Connector (Optional) 3-3

TABLE OF CONTENTS (cont)

PAGE

CHAPTER 3 - OPERATION (cont)

3.2.17 Norm/Tim Switch 3-4
3.2.18 Int-Ext One MHz Switch 3-4
3.2.19 Freq. Adj. (Coarse, Fine) 3-4
3.3 Accuracy of Measurement 3-4
3.3.1 Oscillator Stability 3-4
3.3.2 Gating Error 3-5
3.3.3 Count Error Produced by Noise in Frequency Measurements 3-6
3.3.4 Loading Error 3-7
3.3.5 Trigger Error 3-8
3.4 Equipment Operation 3-9
3.4.1 Test Function 3-10
3.4.2 Frequency (RATE) Measurements 3-11
3.4.3 Count (Totalize) Measurements 3-12
3.4.4 Hold Function 3-12
3.4.5 Time Interval Measurements 3-13
3.4.6 Period Measurements 3-13
3.4.7 Ratio Measurements 3-13

CHAPTER 4 - MAINTENANCE/CALIBRATION

4.1 Factory Service 4-1
4.2 Routine Maintenance 4-1
4.3 Printed-Circuit Board Repair 4-2
4.4 Parts Location 4-3
4.5 Operational Test Procedure 4-3

CHAPTER 1 GENERAL DESCRIPTION

1.1 BASIC FUNCTIONS

The SD 7015 500 MHz Counter is a light weight, rugged portable frequency counter. Simplicity of design and integrated circuit construction insure the highest reliability.

The SD 7015 is a solid-state instrument eminently capable of performing a wide range of counting and timing measurements. It has six basic measuring modes: Rate (frequency), Count (totalize), Hold, Time Interval (Start-Stop), Period (single or multiple), and Ratio (f_1/f_2).

1.2 STANDARD FEATURES

Simple, reliable, accurate operation and easy maintenance are hallmarks of the SD 7015. Its circuitry, completely solid state, is constructed on printed circuit plug-in modules. Test points are color coded and functionally placed for troubleshooting. The seven digit in-line readout displays an answer continuously until the end of the next measurement cycle.

Automatic decimal and units-of-measure indications are provided for all rate and period measurements. The time base crystal oscillator has a stability of better than 3 parts in 10^7/week, after one hour equipment warm-up. The oscillator's stability combined with the variable display time of the seven digit readout results in excellent readability and accuracy.

1.3 APPLICATIONS

The SD 7015 can be employed in the measurement, analysis, and counting of both periodic and random signal pulses of arbitrary waveshape within the rated frequency characteristics of the instrument. Because it operated directly from voltage inputs, it is an invaluable tool for the designing, manufacturing and testing of instruments and circuits having an electrical output related to time interval, frequency; and number of occurances. It is commonly used for the design and calibration of transmitting and receiving equipment, tuned circuits, and crystals. Other common applications are calibration of resolvers and synchros, and the measurement of gain-phase characteristics of closed loop servo systems.

When employed with suitable input transducers (photo cells, magnetic pickups, or switches), the SD 7015 becomes equally valuable for measuring physical events with respect to time; for example: Speed of rotation, flow rate, or production unit counting.

1.4 OPTIONAL FEATURES

A variety of optional features are available to adapt the SD 7015 to many custom requirements. Options include 1-2-4-8 BCD Digital output (suitable for driving digital printers), extra readout tubes (to nine maximum), and a selection of high-stability oscillators. See Chapter 1.5, Specifications, for more detailed optional features information.

1.5 SPECIFICATIONS

FREQUENCY MEASUREMENTS

Range:	0 to 100 MHz (DC input); 10 Hz to 100 MHz (AC input); 10 MHz to 500 MHz (High Frequency input).
Input:	100 mv sensitivity. AC and DC: 1MΩ/50 pF. High Frequency input: 50Ω.
Gate Time:	.01, 0.1, 1, 10 seconds
Accuracy:	±1 count ±time-base accuracy
Reads In:	kHz or MHz with positioned decimal
Self Check:	Counts 1 MHz for gate time selected
Readout:	7 digits in-line

PERIOD AVERAGE MEASUREMENTS

Range:	Single or Multiple Period. 0 to 5 MHz.
Periods Averaged:	1 to 10^5 periods in decade steps
Accuracy:	±1 count ±time-base accuracy ±trigger error. Trigger error is less than ±0.3% of one period ÷ periods averaged for signals with 40 db or better signal-to-noise ratio.
Sensitivity	100 mV from DC to 5 MHz.
Frequency Counted:	1 MHz
Reads In:	µS with positioned decimal point

TIME INVERVAL MEASUREMENTS

Range:	10 µS to 10 sec
Inputs (on rear panel):	Contact closure or saturated NPN transistor to ground. Signal duration: ≥ 1 µS. Current sinking: ≥ 2 mA. The START signal must end before the STOP signal begins. Time from STOP to next START: not less than 30 ms for external reset, or not less than 30 ms + sample time for internal reset.
Frequency Counted:	1 MHz internal time base of external frequency standard.

Readout:	μS with positioned decimal point

RATIO MEASUREMENT

Displays:	(f_1/f_2 X period multiplier; Multipliers: 1, 10, 10^2, 10^3, 10^4, 10^5.
Range, Sensitivity:	f_1: 1 kHz to 2 MHz into external time-base BNC connector, 1V rms minimum into 1000Ω. f_2: 0 to 5 MHz. 10 mV sensitivity except 100 mV below 1 kHz.
Accuracy	±1 count of f_1 ± trigger error of f_2. See Trigger Error note under Period Average Measurements (above).
Readout (legend and decimal):	Indicating but not applicable

TIME BASE

Crystal Frequency:	1 MHz
Stability:	
Aging Rate:	Better than 3 parts in 10^7/week.
Temperature:	±2 parts in 10^8/°C.
Line Voltage:	Less than 2 parts in 10^8 for ±10% change.
Output Frequency:	1 MHz, 3 V p-p minimum open circuit: Source impedance 2000Ω maximum.
External Input:	1 kHz to 2 MHz sine wave, 1 V rms into 1000Ω 10 V rms maximum.

GENERAL

Registration:	7 digits in-line with options to 9.
Display Storage:	Provides a continuous display of the most recent measurement. Switch on rear panel overrides storage.
Sample Rate:	0.2 s to 5 s independent of gate time, or HOLD until manual reset.
Reset:	Manual pushbutton or remote contact closure, or saturated NPN transistor to ground through rear-panel BNC connector.

Operating Temperature Range:	0°C to +50°C
Signal Sensitivity:	Front and High-Frequency input, 100mV rms.
Coupling:	AC or DC, switch selectable.
Attenuation:	Step attenuator with factors of 1, 10 and 100
Input Level:	±1 volt times attenuation factor. A "preset" position of the Trigger Level control automatically centers trigger level at 0 volt.
Overload Without Damage:	75 V peak on X1, 200 V peak on X10, 300V peak on X100 attenuator setting.
Dimensions:	5 1/4" high by 10 1/4" wide by 15" deep.
Weight:	13 pounds net; 15 pounds shipping
Power:	115 V/220 V ±10%, 50 to 400 Hz.

OPTIONAL FEATURES

Designation:

B	High-Stability Oscillator. Aging rate less than 1 part in 10^9 per 24 hours.
B3	Medium-Stability Oscillator. Aging rate less than 3 parts in 10^9 per 24 hours.
B4	Super-High-Stability Oscillator.Aging rate less than 5 parts in 10^{10} per 24 hours.
D3	1-2-4-8 BCD Digital Output: 1 = +3.5V (open circuit); 0 = 0V (nominal). Source impedance 5.7 KΩ. Print command: step from 0V to +5V. Inhibit: 0V inhibits, +10 V operates.
E	Addition of extra readout digits (to 9 maximum).

Operating Temperature Range:	0°C to +50°C
Signal Sensitivity:	Front and High-Frequency input, 100mV rms.
Coupling:	AC or DC, switch selectable.
Attenuation:	Step attenuator with factors of 1, 10 and 100
Input Level:	±1 volt times attenuation factor. A "preset" position of the Trigger Level control automatically centers trigger level at 0 volt.
Overload Without Damage:	75 V peak on X1, 200 V peak on X10, 300V peak on X100 attenuator setting.
Dimensions:	5 1/4" high by 10 1/4" wide by 15" deep.
Weight:	13 pounds net; 15 pounds shipping
Power:	115 V/220 V ±10%, 50 to 400 Hz.

OPTIONAL FEATURES

Designation:

B	High-Stability Oscillator. Aging rate less than 1 part in 10^9 per 24 hours.
B3	Medium-Stability Oscillator. Aging rate less than 3 parts in 10^9 per 24 hours.
B4	Super-High-Stability Oscillator. Aging rate less than 5 parts in 10^{10} per 24 hours.
D3	1-2-4-8 BCD Digital Output: 1 = +3.5V (open circuit); 0 = 0V (nominal). Source impedance 5.7 KΩ. Print command: step from 0V to +5V. Inhibit: 0V inhibits, +10 V operates.
E	Addition of extra readout digits (to 9 maximum).

1.6 RECOMMENDED TEST EQUIPMENT

Table I lists the equipment and publications required to troubleshoot, operate, and calibrate the SD 7015. Substitution of equivalent test equipment for those listed below is acceptable.

TABLE 1

ITEM	DESCRIPTION	NOMENCLATURE	FUNCTION
1	Signal Generator	HP 651B	Troubleshooting/ Calibration
2	Signal Generator	HP 608	Troubleshooting/ Calibration
3	Signal Generator	HP 612	Troubleshooting/ Calibration
4	Sampling Oscilloscope	Tektronix 661	Troubleshooting/ Calibration
5	Oscilloscope	Tektronix 581	Troubleshooting/ Calibration
6	Digital Voltmeter	Systron-Donner 9000	Troubleshooting/ Calibration
7	1 MHz Frequency Standard	1 part in 10^{10} short term stability	Troubleshooting/ Calibration
8	Coaxial Jumper Cable	50 ohms	Troubleshooting/ Calibration
9	Instruction Manual		Operating Instructions

1.7 PREPARATION FOR RESHIPMENT

Should reshipment become necessary, contact the nearest Systron-Donner field office for shipping instructions. If possible use the original packaging materials or repack in accordance with MIL-P-116 and MIL-E-1755E. Systron-Donner field offices can provide materials similar to

those used for original factory packaging. All correspondence should refer to the full nomenclature and serial number of the instrument involved.

CHAPTER 2 INSTALLATION

2.1 INSTALLATION REQUIREMENTS

The SD 7015 has no special installation requirements. It is good practice, however, to make sure the 115V/230V LINE switch setting and the ac power source are the same, to install the unit as far from heat-producing equipment as possible, and to avoid exceeding the operational limits of the counter.

2.2 INSPECTION AND ADJUSTMENT

As soon as the instrument is received, verify that it is intact and as ordered. If shipping damage of any nature is found, refer to the Warranty (inside back cover) and to Paragraph 1.7 for repackaging and shipping instructions.

An overall functional test should be performed as soon as the instrument is received, following a procedure similar to Paragraph 4.5 of this manual. All internal adjustments are initially aligned at the factory: the instrument should be ready for use as received. Should the instrument fail to function properly or fail to meet specifications, contact your Systron-Donner representative.

CHAPTER 3 OPERATION

3.1 PREPARATION FOR USE

Make sure POWER ON/OFF switch is OFF. Determine that the 115v/230v LINE VOLTAGE switch is in the correct position. Connect the SD 7015 to the ac power source.

3.2 CONTROLS, INDICATORS, AND CONNECTORS.

The location of all controls, indicators, and connectors is shown below. The following paragraphs present their functional descriptions.

FRONT PANEL

3.2.1 RECYCLE RATE CONTROL -- turns power on and off and sets counter display time from 0.2 to 5 seconds. When positioned at infinity, the counter displays the last measurement indefinately or until the RESET pushbutton is depressed.

3.2.2 GATE INDICATOR -- lights for the duration of the measurement interval (gate). It provides a positive instrument-is-counting indication, especially when the STORAGE ON display mode is selected.

3.2.3 FUNCTION SWITCH -- (Twelve Positions)

1) PERIOD -- measures time of one to 10^5 periods (in decade steps) if the input waveform.

2) RATE -- measures frequency by counting each input cycle during a selected time base period, 10 millisecs to 10 seconds in decade steps. This switch also controls the automatic decimal point and units-of-measure indicators.

3) COUNT -- totalizes the number of cycles applied to the INPUT BNC.

4) HOLD -- an extension of the COUNT mode. When HOLD is initiated the COUNT function ceases and the counter retains and displays the accumulated count. When the COUNT mode is again selected, the counter continues to totalize from the point at which HOLD was initiated.

3.2.4 READOUT INDICATORS -- consist of seven (options to nine) numerical indicator tubes and an automatically positioned decimal point.

3.2.5 INPUT ATTENUATOR -- selects attenuation networks which will decrease input signal amplitude by a factor of 10 or a factor of 100. The TEST position provides a convenient means of self-testing the counting circuits.

3.2.6 TRIGGER LEVEL CONTROL -- is used to select a dc voltage level which will produce consistent triggering of the counting circuits. The PRESET position centers the trigger level, automatically, at zero cross-over.

3.2.7 ANNUNCIATOR ASSEMBLY -- indicates units-of-measure in kHz, MHz, µs, and OS (off scale).

3.2.8 AC-DC SWITCH -- permits ac or dc coupling of the input signal. The AC position, via a .1 µfd capacitor in series with the INPUT connectors, ac couples the input signal to the counter's input amplifier.

3.2.9 INPUT CONNECTOR -- accepts an input signal (front panel).

3.2.10 RESET PUSHBUTTON -- manually resets the counter to zero. When this switch is pushed, the counter first resets to zero and then begins its next counting cycle.

3.2.11 HIGH FREQUENCY INPUT -- accepts input signals of from 10 MHz to 500 MHz.

3.2.12 RANGE SWITCH -- routes the input signal to the proper section of the 100 MHz Amplifier and Decade PC Board Circuitry and is placed in the 500 MHz position for all input signals 100 MHz or larger.

3.2.13 115v/230v LINE SWITCH -- adapts the SD 7015 to either a 115 V ac or 230 V ac primary power source. Do not apply 230 ac to the unit with this switch in the 115V position.

3.2.14 STORAGE ON/OFF SWITCH -- allows the SD 7015 to hold and display the last measurement taken until the next measurement-interval (ON position). In the OFF position, storage is defeated and the display constantly updates itself.

3.2.15 RESET CONNECTOR -- allows the counter to be reset remotely by a contact closure to ground. See "RESET", Paragraph 1.5.

3.2.16 BCD OUTPUT CONNECTOR (Optional) -- provides the display-readout information in binary coded decimal form for use with peripheral equipment.

3.2.17 NORM/TIM SWITCH -- permits time inverval measurements to be made by the counter (TIM position). The TIM position, essentially, instructs the counter to count 1 MHz for a certain time interval, determined by the two signals applied to the START BNC and the STOP BNC. See Paragraph 1.5, under Time Interval Measurements. All counter functions, other than TIM, are accomplished with the NORM/TIM switch in the NORM position.

3.2.18 INT-EXT ONE MHz SWITCH -- supplies a 1 MHz counter output signal, (derived from the internal time base) to the 1 MHz BNC (INT position) or accepts an external 1 MHz time base input at 1 MHz BNC (EXT position).

3.2.19 FREQ. ADJ. (Coarse, Fine) -- are used to adjust the internal time base oscillator frequency to 1 MHz. See the Maintenance-Calibration Chapter 4 for more detailed information.

3.3 ACCURACY OF MEASUREMENT

If the SD 7015 is to be used to make critical measurements, several factors which may cause errors in counter measurements must be considered. The following paragraphs will illustrate most types of counter errors and present practical solutions to problems created by such errors.

3.3.1 Oscillator Stability

Digital frequency measurements are subject to several types of errors. One of the most significant is inaccuracy of the timing interval, as determined by stability of the crystal-controlled oscillator. The three commonest causes of oscillator instability are the oscillator's inherent aging rate (usually 1 part in 10^6

to 5 parts in 10^{10}), operation temperature variations, and line (supply) voltage fluctuations.

Errors due to oscillator instability may be reduced by the following techniques:

1) By leaving the counter on all the time. The aging rate of an oscillator is greatest when it is first turned on. As an example, the high stability oscillator available for Systron-Donner counters has an aging rate of 1 part in 10^9/day after 30 hours continuous operation. After 60 days continuous operation, the aging rate improves to 2 parts in 10^{10}/day.
2) By frequent calibration with a frequency standard (periodic comparison against a primary frequency standard allows the oscillator to be corrected for drift.
3) By substitution of an external oscillator in place of the standard internal oscillator. If an oscillator with better stability than that of the counter is readily available, it should be used.

3.3.2 Gating Error

Gating error is responsible for a possible error of ±1 count (in the least significant digit of the display) in almost all types of counter measurements. This error is possible because the incoming signal passing through the count gate is not synchronized with the time base pulses which control the gate.

The first or last cycle of the input signal may or may not pass through the gate during the selected measurement interval.

For high frequency measurements, the ±1 count gating error is insignificant compared to the total count. At low frequencies, however, this error may become important. For this reaseon, the period mode of measurement is normally used to obtain greater accuracy.

Gating error can be reduced by a factor of 10 by extending the interval of measurement (Period x 10, etc.). The total count is multiplied by ten but the gating error remains ±1 count.

For example, if a 10 kHz is measured over a 0.1 second time base, the count indicated would be 1000 ±1 and the percentage of error would be ±0.1%. Measured over a 1 second time base, the count indicated would be 10,000 ±1 and the percentage of error would be reduced to ±0.01%.

3.3.3 Count Error Produced by Noise in Frequency Measurements

Noise superimposed on the input waveform may cause spurious count pulses to appear at the output of the input amplifier, which might then be counted. If this should happen an output pulse occurs, and is counted, each time the input signal crosses and re-crosses the selected amplifier trigger voltage level. Since an input signal cycle must usually have amplitude of at least

0.2 to 0.3 volts p-p to cause triggering, spurious counts can be eliminated by attenuating the total "input plus noise" signal to a suitable amplitude.

It is important to have both attenuator and trigger level controls set properly when measuring signals under marginal conditions of noise.

3.3.4 Loading Error

One frequently overlooked and generally not significant error may occur if the connection of the instrument to the external signal causes a frequency or amplitude shift of the external signal.

This error will only be noticed with signal sources of relatively high impedance (high frequency signal) in comparison to the input impedance and frequency rating of the counter.

For signals of sufficient amplitude, the loading error can be reduced by placing either a small coupling capacitor or a large resistor in series with the input signal. The isolating component should be located at the signal source so that it will also isolate the cable capacity.

The loading caused by connecting the input impedance to the start and stop channels of a specific signal source, can be calculated to determine if the source of error is significant. For example, if a counter with a 10 megohm input impedance is used with a signal source having a 10,000 ohm output impedance, the effective value of this resistor is changed by approximately

0.1%. This would be equivalent to shifting the phase of a 60 cycle signal by approximately 0.23 degrees.

3.3.5 TRIGGER ERROR

In addition to gating error, oscillator drift and loading errors, the Period and related Time Interval Measurements are subject to a trigger time error caused by noise on the input signal.

The total signal may be considered as an ideal noise free signal with a superimposed noise signal. The noise added to the ideal signal may trigger the channel before or after the selected instant for triggering. The maximum error in time for a given p-p noise voltage (Vn) and the slope of the ideal signal at the trigger level is:

$$t\ (\text{sec}) = \frac{Vn \quad (\text{volts})}{\text{Slope} \quad (\text{volts/sec})}$$

The maximum percent error is

$$\text{Max. \% error} = \frac{t \times 100\ (\text{sec})}{T\ (\text{sec})}$$

For a sine wave triggering at its zero cross-over point:

$$\text{Max. \% error} \pm \frac{Vn \times 100\ (\text{volts})}{Vs \quad (\text{volts})}$$

This error effectively lengthens or shortens the period measurement. The percentage of error is given by the formula 100/T, where "T" is the trigger error (in seconds).

From the foregoing discussion, it can be seen that as the amplitude of signal voltage is increased, the percentage of error is diminished.

In addition, if the trigger level is set at the center of the steepest slope of the waveform, the maximum error will be reduced.

Another way to reduce trigger error is to measure multiple periods of the gating signal. Since this error occurs only with the first and last pulses of the measuring interval, the trigger error will be reduced by a factor of 1/M if the measurement is extended for M periods.

The various errors add up in the following manner (as depicted in Table 2) to form the total error for each of the functions.

TABLE 2 TOTAL ERROR

FUNCTION	ERRORS PRESENT
RATE	GATING + DRIFT + LOADING
PERIOD & TIME	GATING + DRIFT + TRIGGER + LOADING
RATIO & GATE	GATING + TRIGGER + LOADING

3.4 EQUIPMENT OPERATION

The following paragraphs explain the functional operation of the counter. All of the following operating procedures have a "counter ON and warmed up" prerequisite.

From the foregoing discussion, it can be seen that as the amplitude of signal voltage is increased, the percentage of error is diminished.

In addition, if the trigger level is set at the center of the steepest slope of the waveform, the maximum error will be reduced.

Another way to reduce trigger error is to measure multiple periods of the gating signal. Since this error occurs only with the first and last pulses of the measuring interval, the trigger error will be reduced by a factor of 1/M if the measurement is extended for M periods.

The various errors add up in the following manner (as depicted in Table 2) to form the total error for each of the functions.

TABLE 2 TOTAL ERROR

FUNCTION	ERRORS PRESENT
RATE	GATING + DRIFT + LOADING
PERIOD & TIME	GATING + DRIFT + TRIGGER + LOADING
RATIO & GATE	GATING + TRIGGER + LOADING

3.4 EQUIPMENT OPERATION

The following paragraphs explain the functional operation of the counter. All of the following operating procedures have a "counter ON and warmed up" prerequisite.

3.4.1 Test Function

1) Place the ATTENUATOR switch in the TEST position.

2) Turn RECYCLE RATE control fully counter-clockwise, but not OFF (minimum display time).

3) Turn STORAGE switch ON.

4) Place INT-EXT switch in INT (internal) position.

5) Beginning with 10^{-2} (100 Hz), place the FUNCTION switch in each of its "time base" (RATE) positions. Observe that the indications are as shown in Table 3 -- agreement with Table 3 signifys fully operational counting circuitry.

TABLE 3

Function Switch Position	Correct Indication
100 Hz (10 ms time base)	001.0000 MHz
10 Hz (100 ms time base)	01.00000 MHz
1.0 Hz (1 sec time base)	1000.000 kHz
0.1 Hz (10 sec time base)	000.0000 kHz, OS
0.1 Hz (8 digit readout)	1000.0000 kHz
0.1 Hz (9 digit readout)	01000.0000 kHz

3.4.2 Frequency (RATE) Measurements

1) Set the FUNCTION switch to the RATE position which will result in the desired resolution. See Table 4.

TABLE 4

↑ RESOLUTION ↓	10 ms	100 ms.	1 sec.	10 sec.
	100 Hz.	10 Hz.	1 Hz	0.1 Hz.

← FUNCTION SWITCH RATE POSITION →

2) On the rear panel, set the INT-EXT switch to INT. Set the STORAGE switch as desired.

3) If the amplitude of the frequency to be measured is known, set the ATTENUATOR switch as follows: If the input amplitude is between 0.1V and 1.0V p-p, set range to 10, if above 1.0V p-p, set range 100.

   CAUTION: The counter will not operate properly with input signals above 150V peak-to-peak and signals greater than 250V p-p will damage the instrument.

   If the amplitude of the signal to be measured is unknown, place the ATTENUATOR switch to 100. Perform Step 4, then decrease the attenuation range until correct operation is observed.

4) Apply the signal to be measured to the appropriate input connector (100 MHz or 500 MHz) and set the RANGE switch as applicable.

5) Set the AC-DC switch as desired.

6) Rotate the TRIGGER LEVEL control until a stable count is observed on the indicators. If no count is observed place the ATTENUATOR Switch in the next lower range.

NOTE: It is normal for the less significant digits to fluctuate. Most input signals will have enough instability to cause some variation.

3.4.3 Count (Totalize) Measurements

1) Set the ATTENUATOR switch as in Paragraph 3.4.2 step 3.
2) Apply signal to be counted to the appropriate INPUT connector. (See Step 4 of Paragraph 3.4.2).
3) Place the AC-DC switch as desired.
4) Put the FUNCTION switch to COUNT.
5) Rotate the TRIGGER LEVEL control until the indicators begin to cycle (the storage feature is automatically defeated in COUNT).
6) If the count is to begin at a particular point in time, place the FUNCTION switch in HOLD (which stops the count), depress the RESET momentary pushbutton (which sets the indicators to zero), and then return the FUNCTION switch to COUNT at the desired "start" time.

3.4.4 Hold Function

1) Set the FUNCTION switch to HOLD -- the count will stop and remain displayed. The count may be set to zero by initiating reset, either remotely or with the RESET pushbutton.
2) To resume the count or start a new count, return the FUNCTION switch to COUNT.

3.4.5 Time Interval Measurements

1) Set the FUNCTION switch to the COUNT position.
2) Place the NORM/TIM switch in the TIM position
3) Apply acceptable start and stop signals (see Paragraph 1.5, the Time Interval Measurements Input section) to the START and STOP input BNC connectors.
4) Be sure the NORM/TIM switch is in the NORM position for all functions except time interval measurement.

3.4.6 Period Measurements

1) Set the FUNCTION switch to the desired PERIOD position.
2) Set the ATTENUATOR switch as in Paragraph 3.4.2, Step 3.
3) Set the AC-DC switch as desired.
4) Apply the signal to be measured to the 100 MHz INPUT connector and place the RANGE switch in the 100 MHz position.
5) Rotate the TRIGGER LEVEL control until a stable indication is displayed. If no indication is displayed, select the next lower ATTENUATOR switch range position. Should the indication be unstable, check the frequency, amplitude, and stability of the input signal.

3.4.7 Ratio Measurements

1) Set FUNCTION switch to the PERIOD position which provides the desired resolution.

2) Place the INT-EXT switch to EXT.

3) Apply the f_1 signal input, 1 kHz to 2 MHz, to the 1 MHz BNC connector.

4) Apply the f_2 signal input, 0 to 5 MHz, to the 100 MHz INPUT connector. RANGE switch should be in the 100 MHz position.

5) Adjust TRIGGER LEVEL control for most stable indication. The counter indication will be the ratio between f_1 and f_2 times the PERIOD position multiplier.

CHAPTER 4

THEORY OF OPERATION

4.1 GENERAL THEORY OF OPERATION (Figure 12)

The counter is composed of four basic elements: An input amplifier, a time base circuit, a function switching circuit, and a counting circuit. Changing the relationship of these basic elements with the FUNCTION switch enables the counter to perform its various functions.

4.2 BASIC CIRCUITS

Shaping and amplification of the input signals is accomplished by the input amplifier. The front panel controls for the input signal (AC/DC switch, ATTENUATOR switch, and the TRIGGER LEVEL control) all connect to this amplifier. Outputs from the amplifiers feed the switching circuits as either "count" or "stop/start" signals, depending on the operation being performed.

The counter time base provides the precise frequencies needed for rate and period measurements. Divider circuits process the output of a crystal oscillator to provide the frequencies required by the counter. The front panel TIME BASE and FUNCTION switches determine the disposition of these frequencies. Outputs from the time base are sent to the switching circuit as either "count" or "stop/start" signals. The INT-EXT switch and 1 MHz IN/OUT jack (rear panel) permit the use of an external oscillator.

The switching circuit regulates the passage of the trigger signal to the counting circuit. There are two elements in the switching circuit: A gate generator that receives "start/stop" signals and produces a control gate signal and an electronic switch that receives a "count" signal and produces the counting circuit trigger. The source of the "count" and "start/stop" signals is controlled by the front panel FUNCTION switch which controls the "Control and Reset Logic". The front-panel indication for the condition of the switching circuit is provided by the Gate Lamp which is on when the electronic switch is closed.

The counting circuit is a chain of decades, or divide-by-ten elements, with their associated indicators and reset circuitry. The selections of decimal point position and annunciator legend are also functions of this circuit. The front-panel RECYCLE RATE control and RESET button are associated with this circuit, as is the rear-panel STORAGE switch.

4.3 CIRCUIT DESCRIPTIONS

The following paragraphs describe and explain the SD 7015 circuitry. A thorough understanding of these circuits should be obtained prior to any attempts to troubleshoot the counter. The SD 7015 Block Diagram, Drawing 27377, is the overall electronic diagram for the counter.

4.3.1 Power Supply

Refer to drawing 27475 -- the Power Supply Schematic.

The SD 7015 power supply converts ac line power (115 or 230 Vac) to the various dc voltages (+225, +15, +5 and -5) required by the measurement circuitry. Power source conversion is easily achieved by changing the position of the AC LINE switch (S5) and the LINE FUSE (F1) value.

Primary (ac) power is directed (via P1, the line cord, the POWER ON-OFF switch, and the 115-230 V switch) to the primary windings of Power Transformer T1. The air-circulating fan (B1) receives its power via T1 primary winding 1-3. The T1 secondary windings transform the primary power to the following voltages: Winding 5-6 produces 170 Vrms, center-tapped winding 7-9 produces 35 Vrms, and center-tapped winding 10-12 produces 15.6 Vrms.

+225 V Supply: The 170 Vrms is applied to a fullwave bridge rectifier, CR103 through CR106, and filtered by capacitor C11.

+15 and -15 V Supplies: 35 Vrms is routed to a dual-fullwave rectifier, CR107 through CR110. The outputs (approximately 20 V) are sent directly to the collectors of series regulators Q2 and Q1 -- the + and - regulators, respectively. R119 and CR117 appropriately bias the base of Q2 to produce, in conjunction with the +5V supply's constant-current-source Q104 circuitry, a regulated +15 V on the emitter of Q2. C6 is the associated filter capacitor. The -15 V supply operates in a like manner with constant-current-source Q106, filter capacitor C7, R120, and CR118.

(±)5 V Supplies: The 15.6 Vrms is sent to a dual-fullwave rectifier (CR101, CR102, CR122, and CR123). Approximately 9 V is then applied to the collectors of two sets of cascaded (for current gain) emitter followers (Q3 and Q4, +5 V supply, and Q5 and Q107, -5 V supply). Each cascaded emitter follower is current supplied by a constant current source (Q104 for +5 V and Q106 for -5 V) and each 5 V supply is precisely regulated by a series regulator transistor (Q105 for +5 V and Q108 for -5 V). R116 (+5 V ADJ) and R127 (-5 V ADJ) allow manual control of the regulator transistor (Q105 and Q108) outputs. The 5 V supplies are referenced to the + and -15 V supply circuits in order to obtain more exacting regulation.

4.3.2 One Hundred MHz Input Board

Refer to Drawing 25561.

The Hundred MHz Input Board comprises an overload protection circuit, an impedance conversion circuit, and a input signal period amplifier-shaper circuit.

C1, R1, R2, CR1, and CR2 form the overload protection circuit. The impedance conversion circuit includes Q1 through Q6, Q8, and Q9 and their associated circuit components. The input signal period amplifier and shaper circuit contains transistors Q11 through Q15 and their associated circuitry.

The input of the impedance conversion circuit (junction of CR1 and CR2) presents a 1 megohm impedance to the input signal. The output of this same circuit (emitter

of Q6) presents a 50Ω impedance to the 100 MHz amplifier and Decade board on Pin 4. This circuit operates in the following manner. The input signal (via connector J1, AC-DC switch S2, ATTENUATOR switch S1, the SD 7015 attenuation network, Pin 1, and the overload protection network) is applied to the gates of field-effect transistor complimentary source followers Q1 and Q4. Q1 and Q4 prevent a dc level shift (from 0 Vdc) from occuring at output Pin 4 with changes in a modulated input signal at Pin 1. The signal is amplified and sent to output Pin 4 via an RC network (R9, R10, C7, C8, and C9) and a push-pull circuit (emitter followers Q2, Q3, and Q6 and inverter Q5). The signal at output Pin 4 is 0.7 times as large as the input signal.

A differential amplifier (field effect transistors Q9 and Q12) compares the impedance conversion network's dc level output (at Pin 4), via R31 and R49, to its dc level input (at Pin 1). When a difference exists between the two, the differential amplifier (in conjunction with emitter-follower Q6) supplies the necessary correctional feedback voltage to the base of Q5 and Q2. Transistors Q8 and Q11 are dynamic filters which make sure no 120 Hz power supply noise is added to the input signal waveform. Q10 acts as a constant current source for the differential amplifier (Q9 and Q12). Potentiometer R27 is adjusted to balance the feedback loop. R34 determines the gain of the period amplifier.

The input signal from the collector of Q6 is also routed to the base of period amplifier Q13. The signal is amplified by Q13, shaped by two Schmitt triggers (Q14 and Q15, Q16 and Q17), and applied to the 100 MHz Amplifier and Decade Board via Pin 2. The signal at Pin 2 is equal in frequency to the input signal and approximately 4.5 volts in amplitude.

4.3.3 One Hundred MHz Amplifier and Decade

Refer to Drawing 25385 and the SD 7015 Block Diagram.

The 100 MHz Amplifier and Decade Board comprises a switching and signal-routing circuit, a amplifier-shaper circuit, and a decade counting circuit.

The switching and signal routing circuit contains (as circuit components) three relays, three diodes (CR6-CR8), current control transistor Q17, and signal routing IC9. If the SD 7015 RANGE switch is in the 500 MHz position, L1 closes swinger S1 (Pin E is connected to Pin 7, Q17 is conducting, so L1 has a path from ground to +15 volts) and the 500 MHz Prescaler input signal is fed to the base of amplifier Q1. The 100 MHz RANGE switch position pulls in L2 in a similar manner. L3 receives the ground path necessary to close swinger S3 from either of two sources -- Pin H (in all PERIOD positions of the FUNCTION switch and in the TIM position of the NORM-TIM switch) or Pin J (TEST position of the ATTENUATOR switch). In addition to exciting winding L3, these ground signals turn off Q17 (which prevents the closure of S1 and S2)

and allow the 1 MHz time base signal to be applied to the amplifier and shaper circuit via the base of Q1. IC9 insures that the 1 MHz oscillator signal will be supplied to Time Base Board Pin U (via Pin 15, Dwg. 25385) in counter TEST and that the signal from the 100 MHz Input Board Pin 2 will be supplied (via Pin 15, Dwg. 25385) to the Control and Reset Board (via FUNCTION switch wafers S4-E and S4-F Pins 7) in PERIOD X 1 and to the Time Base Board Pin U in all other PERIOD positions.

Q1 of the amplifier and shaper circuit amplifies the input signal on its base. The amplified signal passes through emitter follower Q2, is shaped by a Schmitt trigger (Q3 and Q4), and passes through another emitter follower (Q5) before arriving at the collector of Q6.

At this point the decade counting circuit becomes important. If Count Gate IC2B (Control and Reset Board) is disabled (closed), gate-controlled transistor Q15 conducts, Q6 turns on and shunts tunnel diode shaper CR2. The signal that had been on the collector of Q6 is shunted to +5 volts and destroyed.

If Count Gate IC2B (Control and Reset Board) were enabled, the signal on the collector of Q6 would be applied to and shaped by CR2, amplified by the differential amplifier (Q7 and Q8), and sent to the emitters of Q10 and Q11 to trigger the "2" binary. This trigger signal is approximately +500 mV in amplitude and 2 nanoseconds in duration.

The "2" binary consists of a reset amplifier (Q9), two cross-coupling elements (CR4 and CR5), the flip-flop (Q10 and Q11), an output emitter follower (Q18), and output amplifier Q13. L4 and L5 prevent the feedback loops from regenerating. The "2" binary is reset by the $\overline{\text{RESET}}$ signal (Pin V) on the base of Q9. The binary's output signal, equal to one half the trigger signal's frequency, is routed via NOR gate IC1 to a divide-by-five network (IC2-IC4). The outputs of this network are fed to level translators (IC5-IC8) which supply the least significant digit storage register (Display Board) with correct logic level binary coded decimal signals. Emitter-coupled logic integrated circuit packages were used in the divide-by-five network because of their high speed switching capabilities. The output of Pin W is the gated count divided by ten.

4.3.4 Count and Display

Refer to Drawing 25366.

4.3.4.1 Indicator Logic Section

This section provides the circuits necessary to count the output signal from the Amplifier and Decade Board Pin W and store the seven digits of the count during the GATE ON interval. The 100 MHz Amplifier and Decade Board's count decade (the "2" binary and "÷5" network) plus six identical count decades (IC19 - IC25) and seven associated storage registers (IC10 - IC16) are cascaded to achieve this function. Each decade is essentially four flip-flops connected as a binary coded decimal counter. Each provides

a "÷10" output to trigger the next decade counter stage and delivers its count at the end of the GATE ON interval to be stored until the next counting cycle. Each decade is reset to zero by the RESET pulse. When the TRANSFER signal occurs, the information present at the Data Inputs (Pins 2, 3, 6, and 7) of each storage register is transferred to the Q outputs (Pins 16, 9, 15 and 10) and remains there until the next TRANSFER pulse. The Q outputs are routed to the Readout and Drivers Section.

4.3.4.2 Readout and Drivers Section

This section converts the stored BCD information from the Indicator Logic section into 10 digit parallel decimal form to drive the readout tubes. Seven identical BCD-Decimal decoder drivers (IC1-IC7) and cold cathode gas filled indicator tubes are used.

The BCD-Decimal decoder consists of TTL (transistor-transistor logic) circuits which select one of ten built-in decimal output drivers (high breakdown NPN transistors) which in turn drives the readout tube. Decimal point position selection and drive is provided by a ground supplied by FUNCTION switch positions 3 through 6 and 8 through 12 (see Block Diagram, S4-A). The automatic units-of-measure indications operate in a like manner except the ground is supplied by wafer S4-B of the FUNCTION switch.

4.3.4.3 Off-Scale Indicator

This circuit is designed to provide an off-scale indication (OS lamp lighted) whenever the measured input signal exceeds

the readout limits of the display. The off-scale indicator circuit comprises the "CARRY" line, IC29, IC28, QI, the $\overline{\text{RESET}}$ line, and the TRANSFER line.

The negative-going CARRY pulse, from the most significant digit decade, arrives at gate A of IC29 (an inverter) and with its positive-going trailing edge, via the clock input of flip-flop B IC28, sets the Q output of F.F.B. to true (high -- approx. 5V). Upon arrival of the positive TRANSFER pulse, gate C of IC29 is enabled and its low output presets F.F.A. IC28 which produces the high output signal required by the Q output (F.F.A. IC28) to turn on QI and light the OS (off-scale) lamp.

F.F.A remains in the lamp-lit condition until two things happen; the CARRY pulse is no longer generated, and a TRANSFER pulse occurs. This is because each time the negative $\overline{\text{RESET}}$ pulse clears F.F.B. causing the Q output (F.F.B.) to go low, the next CARRY pulse toggles F.F.B. Flip-flop A is the "slave" of "master" F.F.B. and at the time of each TRANSFER pulse, no matter what its state is, F.F.A. assumes the state of F.F.B.

The OS lamp is turned off in the following manner. A $\overline{\text{RESET}}$ signal clears F.F.B. No CARRY pulses are generated (the signal on the readout digits is within the limits of the display). A TRANSFER signal occurs. The TRANSFER pulse and the high $\overline{Q}$ output of F.F.B. (F.F.B. has been cleared) enable gate B IC29. The low output of gate B clears F.F.A. of IC28 which makes the Q outputs of F.F.A.

go low which, in turn, shuts off transistor Q1. The OS lamp goes out because it no longer has a path to ground.

4.3.5 One Megahertz Oscillator/Clock

Refer to Drawings 27348 and 23111. The heated cyrstal oscillator, Y1, and the shaping circuit (Assembly 27109) form the SD 7015 oscillator/clock circuit.

The crystal-controlled oscillator receives its operating voltages (+15 and -15V) on oscillator case pins 4 and 5. The ac line voltage, for the heater windings, arrives at oscillator case pins 1 and 6. The output of the oscillator is routed to Pin C of the 1 MHz Oscillator/Clock assembly.

If the 1 MHz INT-EXT switch is in INT, the oscillator output at Pin C is routed (via the INT-EXT switch, Pin B, and resistor R1) to transistors Q1 and Q2. This Schmitt trigger shapes the 1 MHz into a rectangular wave and saturated amplifier Q3 provides the 1 MHz with approximately 5 volts of swing.

If the INT-EXT switch is in EXT, the Pin C internal oscillator is not used. The external oscillator's input to the SD 7015 is applied to Pin B and is shaped as above.

4.3.6 Time Base Logic

Refer to Block Diagram (27377) and Drawing 25362.

This relatively simple circuitry operates on the principle that dividing the input frequency (by a divisor of 10), since the internal 1 MHz is the signal being counted, is

the same as multiplying the period by a factor of ten.

As a time base, this circuit operates in the following manner. FUNCTION switch S4-G picks off the scaled down 1 MHz at the selected pin (either 2, 3, 4, or 19) and (via S4-G, S4-F, and S4-E) routes this signal to the start and stop pins (F and E) of the Control and Reset PC board.

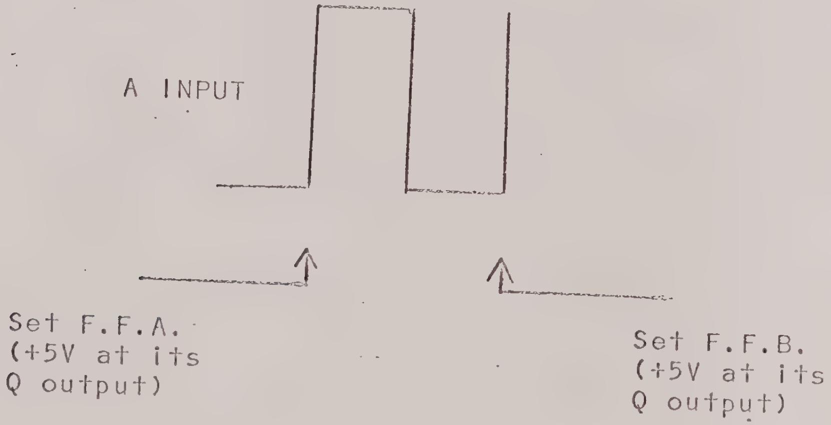
As a period multiplier, the Time Base Logic operates as follows. The input signal arrives at Pin U. The FUNCTION switch S4-C, for example, is in the PERIOD X 10^4 position (a ground is applied to Pin 16). This disables IC5B (the time base signal is stopped at Pin 5 of IC5B) and via inverter IC5A, enables IC5D. The signal is inverted by IC5C and enters the decade chain at Pin 14 of IC6. Its path to Pin 2 is IC7B, IC7C, IC8, IC9B, IC9C, IC10, IC11B, IC11C, and IC12. From Pin 2 (via S4-G, S4-F, and S4-E) the signal is routed to Pins F and E of the Control and Reset assembly -- the start and stop signal pins.

4.3.7 Control and Reset

Refer to Block Diagram and Drawing 25398.

This circuitry is the "heart" of the counter. All counter synchronization procedures are accomplished by this board -- the Count Gate controlling-signals (Gates) A and B (see paragraph 4.3.3), the RESET pulse, the TRANSFER pulse, and the "End of Count" pulse are all produced by the Control and Reset circuitry. The Display Time Generator is also located upon this PC assembly.

4.3.7.1 Count Gate Control: PERIOD X1 -- The amplified and shaped period input is applied to Pins F and E, Control and Reset assembly, by FUNCTION switch S4-F and S4-E. The first positive-going transition of the input pulse "clocks" F.F. IC3A which produces the +5V on its Q outputs (see Figure below). F.F. IC3B does not produce +5V on its Q output during this first positive transition because, the Q output of F.F.A. is connected to the D input of F.F.B. which means F.F.A. must be set before F.F.B. can have a +5V Q output.



At this point (F.F.A. set and F.F.B. clear), Count Gate IC2B is enabled and a 1 MHz signal from the 100 MHz Amplifier and Decade Board is being sent to the display. The next positive transition of the input signl sets F.F. IC3B, its $\overline{Q}$ output goes low (Count Gate IC2B is disabled), and its Q output goes high (Gate IC6A is enabled and prodcues the End-of-Count signal.

PERIOD FUNCTIONS (EXCEPT X1) -- Operation is the same as above except the input applied to Control and Reset Assembly Pins F and E is the counter's input signal divided by

some factor of ten. This division is accomplished in the Time Base circuitry (see paragraph 4.3.6).

RATE FUNCTIONS -- Operation same as above except the Count and Reset assembly Pins F and E input is the selected (FUNCTION switch S4) "sample time" signal generated in the Time Base circuitry by dividing the shaped I MHz oscillator frequency.

COUNT FUNCTION -- When the COUNT position is selected, ground is applied to Preset Pin 4 of IC3A and Clear Pin 13 of IC3B (via NOR gate IC4B and inverter IC4A). As a result, the IC3A Q and IC3B $\overline{Q}$ outputs are high and the shaped input signal is routed, Count Gate IC2B is enabled, to the display. IC2B will remain enabled as long as the ground on pin B of the Control and Reset assembly is applied.

HOLD FUNCTION -- Selection of the HOLD position places a ground on Pin 6 of the Control and Reset assembly. This ground presets ($\overline{Q}$ output low) F.F. IC3B and, via NOR gate IC5C and inverter Q5, clears F.F. IC3A ($\overline{Q}$ output low). The two "lows", in turn, indefinitely disable Count Gate IC2B. The counter remains in HOLD until the ground is removed, via FUNCTION switch S4-C.

T.I.M. FUNCTION -- The external start and stop signals (contact closures to ground) from the START and STOP connectors are applied to the Control and Reset assembly Pins D and 3 respectively. Since Pin C of the C&R assembly is high, the low start signal on Pin 2 ICIA produces a high output on Pin 3. This high is inverted by ICIB, is sent via switch S4-E (Block Diagram) to Pin

F on the C&R assembly, is inverted by IC6C, and "clocks" F.F. IC3A's Q output to +5V. The ground at Pin B of the C&R assembly (for time interval measurements the FUNCTION switch is placed in COUNT) has already preset F.F. IC3A and cleared F.F. IC3B. The +5V at the Q output of F.F. 3A, in conjunction with the +5V $\overline{Q}$ output of F.F. IC3B, enables Count Gate IC2B and allows a 1 MHz signal (time base generated) to be sent to the first storage register in the display, via the 100 MHz Amplifier and Decade Board's BCD output pins. In a like manner as with the start signal, the stop signal arrives at Pin E, C&R assembly, is inverted by IC6B, and toggles F.F. IC3B. The $\overline{Q}$ output of IC3B goes low and the Q goes high. The high at the Q output produces the End-of-Count signal at gate IC6A while the $\overline{Q}$ output of IC3B disables Count Gate IC2B. Gate-Controlled Transistor Q15 (Dwg. 25383) is shut off which turns off Gate transistor Q6 (Dwg. 25385). The 1 MHz signal on the collector of Q6 is shaped, amplified, and sent to trigger the binary, Q10 and Q11 (Dwg. 25385). The time interval is displayed, in microseconds, on the readout.

TEST FUNCTION -- In TEST, the Start and Stop Binary IC3A and B has one of the four selectable time bases as its start and stop inputs (FUNCTION switch RATE positions). Operation of IC3 is identical to its Rate positions operation. See Paragraph 4.3.3 for the differences in 100 MHz Amplifier and Decade Board operation in TEST.

4.3.8 Timing Pulses

The End-of-Count signal is produced by gate IC6A. The output of this gate is positive until end-of-count (both Q outputs

of Binary IC3 are high (+5V). See Figure 9.

The EOC signal, via R5, is applied to the base of Q2. Q2 turns off and C3 begins to charge (at a rate determined by R7 [C&R assembly], R7 [RECYCLE RATE], the +225 V supply, and C3) to the positive value which will fire unijunction transistor Q3. The negative 6V pulse generated by Q3 is applied to Reset One-Shot IC5A & B. The one-shot's output (Reset pulse), 100 µsec., 5 volt negative-going pulse, is fed to saturated amplifier Q4, to $\overline{\text{RESET}}$ Pin 8 (C&R assembly) and to the Time Base Inhibit One-shot IC4 C&D. Depressing S9 also causes the Reset pulse to be generated.

The output of the Time Base Inhibit One-shot, approximately 55 msec, 5 volt negative-going pulse has two major functions. This output inhibits the time base, at Pin 8 (C&R assembly), while it clears the Start-Stop Binary IC3A & B. It also clears F.F. IC3A via NOR gate IC5C and inverter Q7 and clears F.F. IC3B via NOR gate IC4B and inverter IC4A.

The EOC signal (via C8, R19, and CR4) is delayed and applied to saturated amplifier Q6. When the STORAGE ON-OFF switch is in OFF, pin S of the C&R assembly is grounded and Q6 is held off so all counting information is constantly being transferred to the readout. CR4 isolates this ground from the Reset and Start-Stop circuitry. IC2C and D compose the Minimum Lamp Time One-shot. The output of NOR gate IC2A is either the output of IC2C and D or the length of time Measurement Interval Gate IC2B is enabled -- whichever is longer. Q1 is the GATE LAMP driver.

The "gate on" signal at Pin 14 of the C&R assembly is the "start-stop counting" signals the counting circuits of the SD 7015.

Pin 17, labeled INHIBIT RESET, is used when the counter has the BCD outputs option and is being operated with a print-out device. The printer supplies this signal to prevent the counter from recycling until the printer is ready to accept new information.

4.3.9 500 MHz Prescaler Board

Refer to the Prescaler Schematic Diagram (25533). The functional sections of this board are: the input limiter and broad-band amplifier, the "2" binary, the shaping circuitry, the "4" binary, and the time base expander. The amplifier and shaper arrangement used with this board insures maximum stability of high frequency performance while the use of tunnel diodes permits the required high-speed switching.

a. INPUT LIMITER. This circuit functions as a balanced bridge with the voltage across CR5 and CR6 following the input across resistors R4, R5, and R6.

The positive and negative limiting levels are set by the supply voltages and the size of the series resistors. For the values indicated, the output is limited to approximately ±1.2 volts. When positive limiting occurs, CR2 and CR3 conduct; CR1 and CR4 block. When negative limiting occurs, CR1 and CR4 conduct; CR2 and CR3 block. The output of the limiter is applied to the first stage of the broad-band amplifier. Transistors Q1, Q2, and Q3 and their associated

circuit components form this 400 kHz to 500 MHz amplifier.

b. "2" BINARY. The output of the broad-band amplifier is coupled by C8 and R20 to tunnel diode Schmitt trigger CR7. R22 is the level adjustment for the trigger. The input signal is further shaped by tunnel diode shaper CR8 before being applied to the input of the tunnel diode binary, CR10 and CR9. Q4 inverts and amplifies the binary output (input frequency divided by two).

c. SHAPING CIRCUITS. CR11, a tunnel diode shaper, is the final shaping circuit in the prescaler. CR7 and CR8, the two other shaping circuits are described in 4.3.9 b. CR11 accepts the output of the "2" binary, differentiates it, and routes it to the "4" binary's input differential amplifier, Q6 and Q7. The output of Q7 triggers the flip-flop (Q9 and Q10). Q9 is the "0" side and Q10 is the "1" side of the flip-slop. Q8 and Q11 are the flip-flop's output amplifiers. The "4" binary's output signal (Pin X of the Prescaler Board) is a rectangular wave approximately 5 volts in amplitude whose frequency is equal to the Prescaler input signal frequency divided by four.

d. TIME BASE EXPANDER. This circuit comprises IC2, a dual J/K master-slave flip-flop, and IC1, a quadruple dual-input Nand gate. Because the Prescaler divides the input frequency by four, the gate time (measurement interval) must be multiplied by four in order to achieve a direct display reading of the input frequency.

IC2's external circuitry insures that four consecutive selected

(FUNCTION switch S4-G) time base gates applied to the input of IC2 (Pin 5) result in one expanded (by 4) time base gate at IC2-s output (Pin 12). IC1, essentially, controls the distribution of the expanded time base gate. If the RANGE switch is placed in the 500 MHz position, Nand gate IC1A is enabled (via inverter IC1D and a ground on the 100 MHz Amplifier and Decade Board) and the expanded gate is sent to the Control and Reset start and stop lines (when the FUNCTION switch is in RATE positions) via output Pin U (Prescaler) of the expander. At this same time Nand gate IC1C is disabled.

When the RANGE switch is put in the 100 MHz position, IC1C is enabled and IC1A is disabled (via inverter IC1D and CR16). So, the selected time base gate input, at Prescaler Pin T, is simply routed through inverter IC1B and enabled IC1C to the Prescaler's time base output Pin U. The expanded time base gate is blocked by disabled IC1A.

CHAPTER 5 MAINTENANCE/CALIBRATION

5.1 FACTORY SERVICE

Whenever the instrument requires service, the nearest Systron-Donner representative should be contacted. He can provide field service or arrange factory returns when necessary. Address all inquires on operation or application to your nearest sales representative, or to Sales Manager, Systron-Donner Corporation, 888 Galindo Street, Concord, California, 94520. Specify both model and complete serial number in all correspondence.

5.2 ROUTINE MAINTENANCE

A regular program for routine maintenance and inspection every five to six months is recommended for this counter (the oscillator may require calibration at more frequent intervals). As part of these regular procedures, the instrument should be checked in the following manner:

a) Disconnect ac power and remove the top and bottom covers by removing the rear panel retaining frame (six screws).

b) Make a thorough inspection of all wiring and cables. Check for frayed, loose, or burned wires.

c) Check for physical integrity of all components. Look for burning or cracking, loose solder connections, leakage of insulation compounds, and general physical damage. If a printed circuit board contains integrated circuit packages, ensure that all packages are firmly mounted. Never unnecessarily remove and replace a package.

d) Check all front panel switches and controls for loose or broken terminals, loose or sticking shafts, etc.

e) If the internal panel surfaces and components have an excessive amount of dust deposited on them, use a soft brush and low pressure stream of air to remove the foreign material.

CAUTION

Do not clean PC boards or small internal components with a stiff brush or solvents, since damage to the circuits may result. A high-powered vacuum cleaner device should not be used on small internal components.

f) Wipe the external surfaces of the instrument with a soft damp cloth to remove dirt, fingerprints, and other foreign material.

g) Replace the top and bottom covers and reconnect ac power. Perform the Operational Test Procedure (Paragraph 4.5). If performance does not match or exceed the specifications listed in Chapter 1 of this manual, contact your Systron-Donner representative.

5.3 PRINTED-CIRCUIT BOARD REPAIR

To remove a part on a printed circuit board, cut the leads of the part near the lead holes. Using a low power (50 watts or less) soldering iron, apply heat sparingly to each cut lead. As soon as the solder melts, slip the lead from the hole and clean the hole with a toothpick. Clean the board surfaces with iroprophyl alcohol. Form the tinned leads of the replacement part and insert in cleaned holes, trimming leads to extend 1/16 inch beyond the back surface of the board. Only 63-37 solder with a maximum diameter of 1/16 inch should be used. Solder the leads to the board and use a hemostat, long-nosed pliers, or other heat sink on all leads of all semiconductor devices and quarter-watt resistors. Allow the soldered junction to cool before removing the heat sink.

5.4 PARTS LOCATION

Printed circuit board outline drawings, with each part located upon the drawing, are located in Chapter 6.

5.5 OPERATIONAL TEST PROCEDURE

The following procedure will establish that the SD 7015 500 MHz Counter circuits are functioning correctly. It is written

with the assumption that the SD 7015 under test is equipped with seven readout digits and the standard time base oscillator. Correct indications for other configurations of the SD 7015 (optional equipment), if included, are shown in Chapter 7 of this manual.

STEP	ACTION	INDICATION
1	a) Connect SD 7015 to ac power; make sure LINE switch agrees with power source	
	b) INT-EXT switch to INT. NORM/TIM switch to NORM	
	c) TRIGGER LEVEL control to PRESET	
	d) STORAGE switch to ON	
	e) ATTENUATOR switch to TEST	
	f) FUNCTION switch to PERIOD X 1	
	g) POWER ON/OFF and RECYCLE RATE control to ON and mid-range	Display illuminates, reads 0000001 ±1 µ sec. A 1 MHz 3V p-p signal is available at the 1 MH OUT connector.
	h) FUNCTION switch to X10	Display reads 000001.0 ±0.1 µ sec
	i) FUNCTION switch to X10^2	Display reads 00001.00 ±.01 µ sec
	j) FUNCTION switch to X10^3	Display reads 0001.000 ±.001 µ sec
	k) FUNCTION switch to X10^4	Display reads 001.0000 ± .0001 µ sec
	l) FUNCTION switch to X10^5	Display reads 01.00000 ±.00001 µ sec
2	a) FUNCTION Switch to COUNT	Display totalizes at a 1 MHz rate. The GATE lamp is constantly on. No decimal point or legend information is displayed.

STEP	ACTION	INDICATION
	b) FUNCTION switch to HOLD	Display holds count indefinately. GATE lamp is constantly off.
	c) FUNCTION switch to COUNT	Display begins to totalize again from point at which HOLD was initiated
3	a) FUNCTION switch to .1 Hz	Display reads 000.0000 ±.0001 kHz, Off-scale (OS) lamp illuminates.
	b) FUNCTION switch to 1 Hz	Display reads 1000.000 ±.001 kHz. OS lamp goes out.
	c) FUNCTION switch to 10 Hz	Display reads 01.0000 ±.00001 MHz
	d) FUNCTION switch to 100 Hz	Display reads 001.0000 ±.0001 MHz
4	a) RECYCLE RATE full CCW but not to OFF	Display time should be 0.2 seconds or less
	b) RECYCLE RATE full CW but not to ∞	Display time should be 5 sec. or greater
	c) Depress RESET button several times	Counter should reset instantly each time (GATE lamp should flicker).
	d) RECYCLE RATE to ∞	Counter no longer resets automatically at end-of-measurement. It will reset manually however.
5	a) RECYCLE RATE full CW (not ∞)	Display reads as in 3d above
	b) STORAGE switch to OFF	Counter resets to 0, then counts to 3d.
	c) Return STORAGE switch to ON	
6	a) ATTENUATOR to 1	
	b) Place INT-EXT switch to EXT	
	c) Apply 1 MHz frequency	

STEP	ACTION	INDICATION
	standard, 1 V rms, to 1 MHz connector	
	d) Apply 5 MHz, 100 MV, to 100 MHz INPUT connector	
	e) FUNCTION switch to PERIOD X 10^2	Display reads ~~00000.00~~ 00000.20 µ sec, but legend and decimal point are not applicable in RATIO
	f) Remove inputs and return INT-EXT switch to INT	Display reads 00000.00 µ sec
7	a) FUNCTION switch to COUNT	Display reads 0000000.
	b) Vary TRIGGER LEVEL about zero, plus to minus and minus to plus	Display should register count each time the control passes through zero going from ~~minus~~ plus to ~~plus.~~ minus
	c) TRIGGER LEVEL to PRESET	
8	a) FUNCTION switch to 1 Hz	
	b) ATTENUATOR switch to ~~10~~ 1	
	c) STORAGE ON/OFF to OFF	
	d) Apply a 100mV, variable frequency source to the A INPUT connector.	
	e) Beginning with a low frequency (approx. 1Hz) gradually increase the input signal frequency and check each numerical indicator tube for 0 through 9 sequencing -- numbers should be clear and distinct	
	f) Remove test jumper, turn ATTENUATOR switch to 1, and flip STORAGE switch to ON.	
9	a) FUNCTION switch to 10 Hz	
	b) Apply 100 mV, 100 MHz signal to 100 MHz INPUT. RANGE	

STEP	ACTION	INDICATION
	switch to 100 MHz.	
	c) Adjust TRIGGER LEVEL control for correct indication	Display should read 00.00000 ±.00001 MHz. OS lamp lights.
	d) Remove 100 MHz input and apply a 100 mV, 500 MHz signal to 500 MHz INPUT connector. RANGE switch to 500 MHz.	
	e) Readjust TRIGGER LEVEL control for correct indication.	Display should read 00.00000 ±.00001 MHz. OS lamp lights.
	f) Remove 500 MHz input signal.	
10	a) FUNCTION switch to COUNT	
	b) NORM/TIM switch to TIM	
	c) RECYCLE RATE to ∞	
	d) Ground rear panel START BNC	Counter should begin counting at a 1 MHz rate.
	e) Remove START BNC ground	
	f) Ground rear panel STOP BNC	Counter stops counting and displays in µsec the time between the START BNC going to ground and the STOP BNC going to ground.
	g) Remove STOP BNC ground and return RECYCLE RATE to midrange	
	h) Return NORM/TIM switch to NORM	SD 7015 is operating correctly

5.6 CALIBRATION

This sub-section comprises the recommended SD 7015 calibration/alignment procedure. The instrument should be calibrated every 60 days, whenever a component is replaced, or after failing the Operational Test Procedure (Sub-section 5.5) -- whichever occurs first. Calibration should be performed in the specified sequence since each step is dependent upon the preceding step. Each test equipment used in this procedure will be referenced to its Sub-section 1.6 Item Number to avoid any ambiguity.

5.6.1 PRELIMINARY

Remove the top and bottom covers (See Sub-section 5.2.a). Check that line voltage is between 105 and 125 V rms or between 210 and 250 V rms, whichever is applicable. Mount Readout Board as per Figure . Connect the unit to line power. Rotate RECYCLE RATE switch to ON.

5.6.2 POWER SUPPLY ADJUSTMENT

1) With DVM (Item 6), monitor Pin 1 of connector J16 (+230 V buss on Readout-Display Board connector). DVM should read +230±20V dc. If it does not, troubleshoot +230V supply and replace faulty component(s). With oscilloscope (Item 4), check J16 Pin 1 for ripple of less than 5 volts.

2) With DVM (Item 6), monitor Pin 11 of connector J9 (+15V buss on 100 MHz Amplifier and Decade Board connector). DVM should read +15±1.5V dc. With oscilloscope (Item 4), check J9 Pin 11 for ripple of less than 20mV. If supply voltage or ripple incorrect, troubleshoot +15V supply and replace faulty component(s).

3) With DVM (Item 6), monitor J9 Pin 12 for -15±1.5V dc. With oscilloscope (Item 4), check J9 Pin 12 for ripple of less than 20mV. If a discrepancy exists, troubleshoot -15V supply and replace faulty component(s).

4) With DVM (Item 6), monitor J9 Pin 10. Adjust R5 (Power Supply Board) for +5V±10mV dc at J9 Pin 10. With oscilloscope (Item 4), check J9 Pin 10 for 20mV or less of ripple. If

supply voltage or ripple incorrect, troubleshoot +5V supply and replace faulty component(s).

5) With DVM (Item 6), monitor J9 Pin 13. Adjust R7 (Power Supply Board) for -5.2V±10mV dc at J9 Pin 13. With oscilloscope (Item 4), check J9 Pin 13 for 20mV or less of ripple. If a discrepancy exists, troubleshoot -5V supply and replace faulty component(s).

5.6.3 OSCILLATOR ADJUSTMENT

Rotate ATTENUATOR switch to TEST. Place 1MHz INT-EXT switch to INTernal. With oscilloscope (Item 4), triggered by the 1 MHz (Item 7) frequency standard, monitor the 1 MHz IN-OUT BNC for a 2.5V peak-peak (minimum amplitude) 1 MHz rectangular wave. Set COARSE frequency adjustment (Counter's rear panel) to position which results in most stationary waveform on scope. Set FINE frequency adjustment (optional oscillators) to position which results in most stationary waveform on scope. Place 1 MHz INT-EXT switch to EXT. Oscilloscope should no longer display 1 MHz signal. Remove calibration equipment.

5.6.4 100 MHz INPUT AMPLIFIER ADJUSTMENT

Set TRIGGER LEVEL control to PRESET. Connect a wire from ground to unmarked lug in center (encircled by Q6, R49, R29, and R31) of 100 MHz Input Amp. Board.

2) With DVM (Item 6), monitor the drains (each in turn) of Q9 and Q12. Adjust R27 (100 MHz Input Amp.) for equal (±5mV) voltage on these points.

3) With DVM (Item 6), monitor lug 4 (between L1 and lug 3 on 100 MHz Input Amp. Board). Adjust R50 (adjacent to Q13 and Q14 on 100 MHz Input Amp. Board) for zero ±5 millivolts at lug 4. Remove ground from unmarked lug in center of board and readjust R24 for zero ±5 millivolts at lug 4.

4) With signal generator (Item 1), apply 1 MHz (100mV) signal to 100 MHz INPUT BNC (Counter's front panel). Set ATTENUATOR switch to "1" and RANGE switch to 100 MHz position. With oscilloscope (Item 4), monitor lug 2 (next to lug 3 on

100 MHz Input Amp. Board). Adjust R34 (next to Q13, 100 MHz Input Amp. Board) for 1 MHz squarewave. Gradually decrease input signal amplitude (Item 1) and continue to adjust R34 for best sensitivity (approximately 35mV).

5) Set FUNCTION switch to COUNT position and disconnect the input from the signal generator (Item 1). Rotate TRIGGER LEVEL control to fully clockwise. One count should be added to the display each time the TRIGGER LEVEL control is rotated from full clockwise to full counter-clockwise.

5.6.5 100 MHz AMPLIFIER AND DECADE ADJUSTMENT

Calibration (or troubleshooting) of this board necessitates the removal of the 500 MHz Prescaler PC Assembly. Short Pin T to Pin U on J7, the Prescaler Assembly connector, and remove the Prescaler PC Assembly.

1) Place FUNCTION switch to COUNT, ATTENUATOR switch to TEST. With DVM (Item 6), observe junction of S1, S2, S3, R2, and R4 on the 100 MHz Amplifier and Decade PC Board (100 A&D Board). Adjust R2 (100 A&D Board) for zero ±20mV at the junction.

2) Observe collector of Q1 (100 A&D Baard) with DVM (Item 6) and adjust R5 (100 A and D Board, adjacent to R9 and C13) for 1.5 volts ±50mV.

3) Place ATTENUATOR switch to the "X1" position. Adjust signal generator (Item 2) for a 125 MHz (100mV) output. Connect generator's output to 100 MHz INPUT connector.

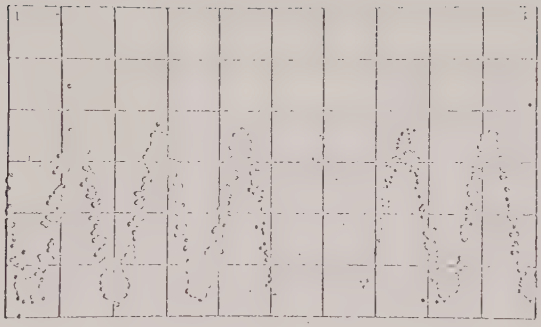
4) With sampling scope (Item 4), observe the junction of S1,S2, and S3 (100 A&D Board) -- Waveform should be quite similar to Waveform #1 on following page (approx. 180mV peak-to-peak swing about a zero volts dc level.

5) Observe the collector of Q1 (100 A&D Board) with sampling scope. Waveform 2 (Page 5-10) should be displayed.

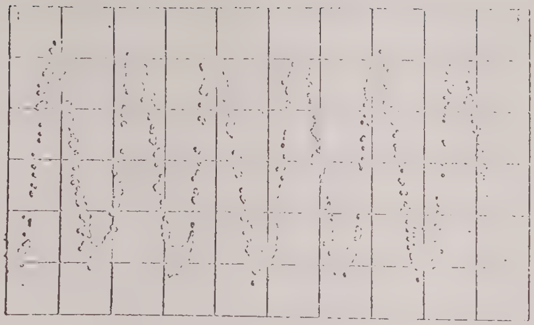
6) Observe emitter of Q5 (100 A&D Board) with sampling scope. Waveform 3 (Page 5-10) should be displayed.

NOTE: A slight adjustment of R5 may be necessary.

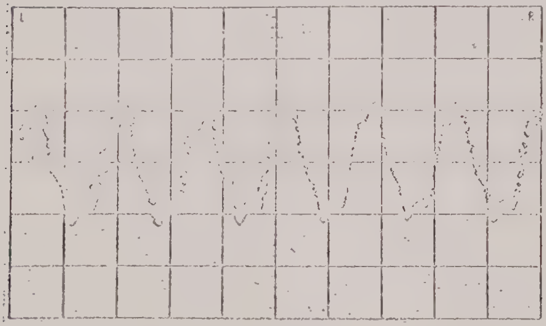
7) Monitor, with sampling scope, the collector of Q7 (100 A&D Board). Adjust R23 (100 A&D Board) for waveform 4 (Page 5-10).



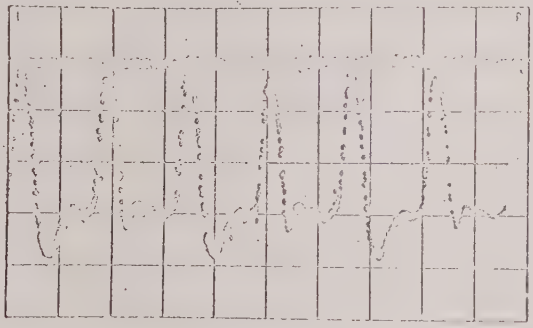
Waveform 1, Amplifier Input (125 MHz, 100 mV rms applied). Monitor R2 and R4 junction. Scope Settings: HORIZ, 5 nsec/cm and VERT, 50 mV/cm. Zero volts dc level.



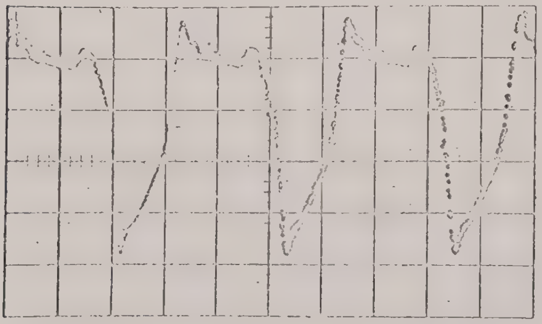
Waveform 2, Amplifier Output. Monitor Q1 collector. Scope Settings: HORIZ, 5 nsec/cm and VERT, 100 mV/cm. AC coupled. 1.55 V dc level.



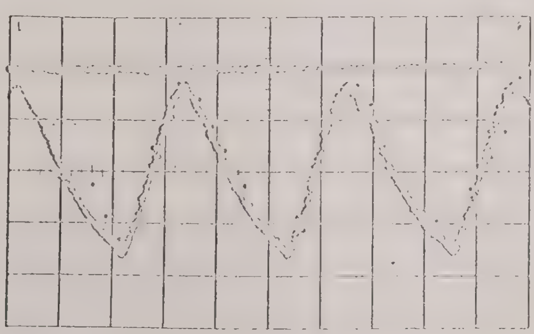
Waveform 3, Schmitt Trigger Output. Monitor Q5 emitter. Scope Settings: HORIZ, 5 nsec/cm and VERT, 200 mV/cm. AC coupled.



Waveform 4, Pulse Shaper. Monitor Q7 collector. Scope Settings: HORIZ, 5 nsec/cm and VERT, 200 mV/cm. DC coupled. Horizontal line is zero reference.



Waveform 5, Binary Output Emitter Follower. Monitor Q18 emitter. Scope Settings: HORIZ, 5 nsec/cm and VERT, 200 mV/cm. AC coupled.



Waveform 6, Binary Buffer. Monitor Q13 collector. Scope Settings: HORIZ, 5 nsec/cm and VERT, 1 V/cm. DC coupled. 0 reference at top.

8) With sampling scope, monitor Q18 emitter (100 A&D Board). Waveform 5 (Page 5-10) should be observed on scope's display (Binary should be dividing by two.)

9) With sampling scope, monitor Q13 collector (100 A&D Board) for a Waveform 6 (Page 5-10) indication. If necessary adjust the value of R53 (Rxx on 100 A&D Board).

NOTE: The positive peak must be within 400mV of ground.

10) Monitor emitter Q18, again, with sampling scope. Waveform 5 (Page 5-10) should still be observed. If not, re-adjust R23 (100 A&D Board).

11) With oscilloscope (Item 5), monitor Pin W (100 A&D Board) for a 12.5 MHz signal approximately 2.5 volts in amplitude.

NOTE: This waveform should be the BCD "8" Bit.

12) Place FUNCTION switch to "100Hz" position and observe counter display indication of 125.0000 MHz. Gradually decrease the input signal amplitude (from signal generator, Item 2) while simultaneously adjusting R5 for best sensitivity -- 100mV or less.

13) Disconnect all calibration equipment, including the short between Pin T and Pin U of Prescaler connector. Re-install 500 MHz Prescaler Board.

5.6.6 500 MHz PRESCALER ADJUSTMENT

A) Initial Adjustments (No Input Applied)

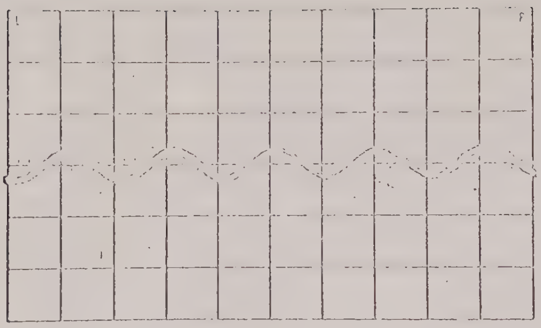
1) Set potentiometers R22 and R37 (Prescaler PC Board) to midrange.

2) Monitor Test Point F (Prescaler) with DVM (Item 6). Adjust R25 (Prescaler Board) for -.530 volts dc. Remove DVM.

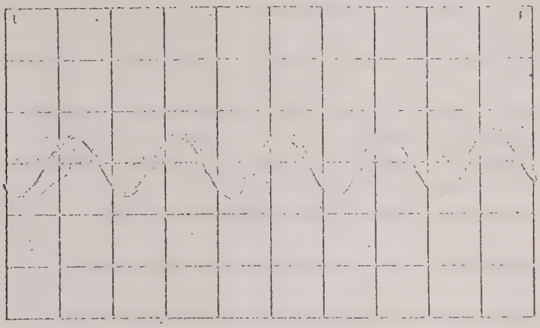
B) Preliminary Checks

1) With the signal generator (Item 2), apply a 100 MHz (100mV rms) signal to the Prescaler input -- RANGE switch to 500 MHz and input signal to 500 MHz BNC connector. With sampling scope (Item 4), monitor Test Point E (Prescaler) and adjust R22 for signal illustrated by Waveform 5 (located on following page).

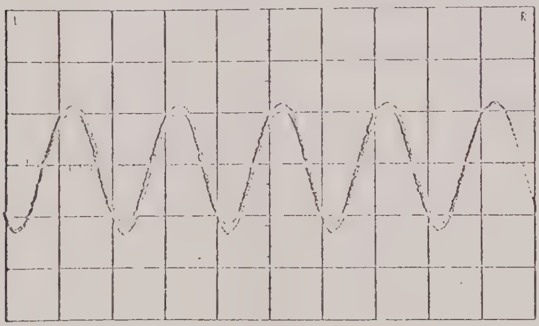
2) With the sampling scope, monitor Test Point H (Pre-



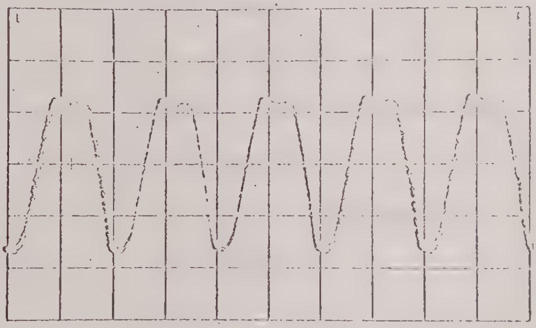
Waveform 1, Input (100 MHz, 100 mv rms applied). Scope Settings: HORIZ, 5 nsec/cm and VERT, 500 mV/cm.



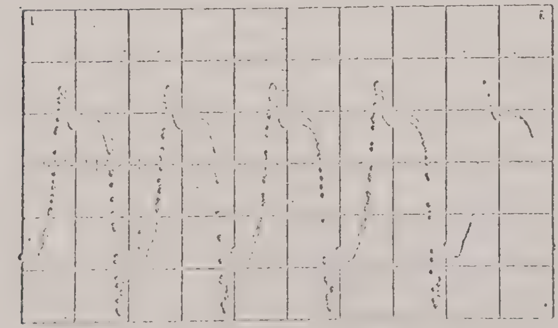
Waveform 2, Q1 Collector. Scope Settings: HORIZ, 5 nsec/cm and VERT, 500 mV/cm.



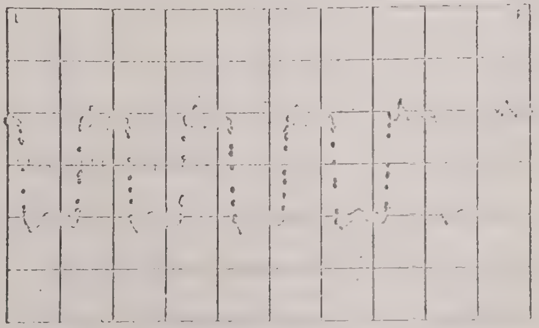
Waveform 3, Q2 Collector. Scope Settings: HORIZ, 5 nsec/cm and VERT, 500 mV/cm.



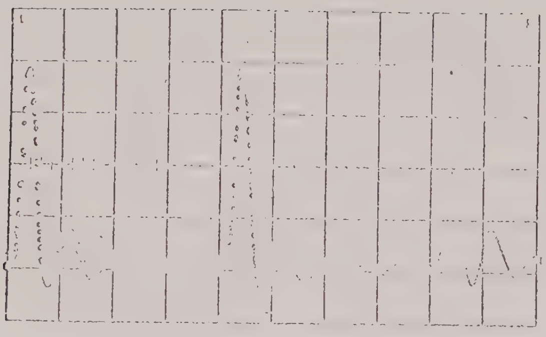
Waveform 4, Q3 Collector. Scope Settings: HORIZ, 5 nsec/cm and VERT, 500 mV/cm.



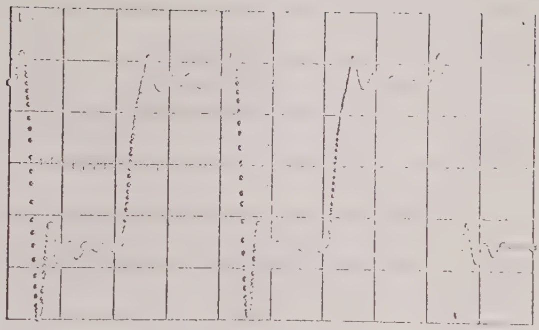
Waveform 5, CR7 Cathode. Scope Settings: HORIZ, 5 nsec/cm and VERT, 200 mV/cm.



Waveform 6, Q4 Base. Scope Settings: HORIZ, 10 nsec/cm and VERT, 100 mV/cm.



Waveform 7, Q6 Collector. Scope Settings: HORIZ, 5 nsec/cm and VERT, 200 mV/cm.



Waveform 8, Pin Y into 50Ω Load. Scope Settings: HORIZ, 10 nsec/cm and VERT, 100 mV/cm.

scaler) and adjust R25 for signal as illustrated by Waveform 6 (Page 5-12).

3) Monitor, with sampling scope, Test Point J (Prescaler) and adjust R37 for signal as illustrated by Waveform 7 (Page 5-13).

4) Monitor, with sampling scope, output Pin K (Prescaler) for a correct division-by-four signal -- as indicated by Waveform 8 (Page 5-13). Remove calibration equipment.

C) First Binary Calibration

1) Connect DVM (Item 6) to Test Point F.

2) Apply, with signal generator (Item 3), a 500 MHz (500mV rms) signal to the 500 MHz INPUT connector, Adjust R25 for LOW voltage limit of operation -- indicated by a division-by-four signal at output Pin K (Use sampling scope).

NOTE: Beyond its HIGH and LOW input voltage operating limits, the Prescaler will divide the input signal by a a factor other than four. Record voltage (LOW limit) at Pin F.

3) Adjust R25 for HIGH voltage limit of operation as indicated by the divide-by-four signal at output Pin K. Record voltage (HIGH limit) at Pin F.

4) Repeat Steps C2 and C3 using Item 2 and Item 3 (signal generators) to generate input signals of 200 MHz, 100 MHz, and 10 MHz respectively.

SAMPLE RECORDINGS

	10 MHz	100 MHz	200 MHz	500 MHz	
HIGH:	.553	.570	.594	.614	Test Point F
LOW:	.480	.483	.494	.515	

4) Voltage readings at each frequency indicate the window of operation for the binary at that particular frequency. To obtain the overall window of operation and the "voltage set point" at Pin F, compute the difference between the maximum LOW LIMIT voltage reading and the

minimum HIGH LIMIT voltage reading (See Sample Recordings above):

$$\begin{array}{r} .553 \\ -.515 \\ \hline .038 \end{array} \qquad .038/2 = .019 \qquad \begin{array}{r} .515 \\ +.019 \\ \hline .534 \end{array} = \text{Voltage Set Point}$$

The difference is divided by two and added to the maximum LOW LIMIT voltage reading to obtain the "voltage set point" at Pin F.

6) Remove input to counter and with no signal applied, monitor Pin F with the DVM (Item 6) and adjust R25 for the "voltage set point" at Pin F.

D) Final Adjustments

1) Alternately apply a 500 MHz signal and a 10 MHz signal (with signal generators, Items 3 and 2) to the 500 MHz INPUT connector. Monitor counter's DISPLAY and adjust R22 (Prescaler) for best common sensitivity setting for both frequencies.

2) With signal generator (Item 3), apply a 350 MHz signal to 500 MHz INPUT connector. Monitor counter's DISPLAY and adjust R37 (Prescaler) for most stable operation.

3) With signal generator (Item 3), apply a 500 MHz signal to the 500 MHz INPUT connector. Monitor counter's DISPLAY and adjust R2 (100 MHz Amp. and Decade Board) to the mid point of operation. The midpoint is the middle of the R2 range in which the counter provides a correct indication of the input signal frequency. Remove calibration equipment. The counter is now fully calibrated and should be ready for use.

E) Troubleshooting

Waveforms 2,3, and 4 (Page 5-12) are provided to Illustrate the gain relationships in the wide-band amplifier. To check amplifier's performance, apply a 100 MHz, 100mV rms signal to the 500 MHz INPUT (RANGE switch still in 500 MHz position) and observe the signal shapes, with the sampling scope (Item 4), at Prescaler PC Board Pins B, C, and D.

SD 7015 MASTER
PARTS LIST

REF.	DESCRIPTION	SD PART NO.
	Main Chassis Assembly	27487
	Front Panel Assembly	27184
	Rear Panel Assembly	27156
	Xtal Oscillator Assembly	27499
	Seven Digit PC Assembly	25942
	Time Base PC Assembly	25365
	Control-Reset PC Assembly	25401
	100 MHz Amp. & Decade PC Ass'y	25388
	500 MHz Prescaler PC Ass'y	25536
	100 MHz Input PC Assembly	25564
	Power Supply PC Assembly	27479

MAIN CHASSIS ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
C6	Capacitor 1000µf 15V	13490
C7	Same as C6	
C9	Capacitor 13,000µf 12V	C1122
C10	Capacitor 1000µf 15V	C1152
C11	Capacitor 20µf 450V	C1150
J7	Connector 22 Pin	J0248
J9	Same as J7	
J10	Same as J7	
J11	Same as J7	
J12	Same as J7	
J13	Same as J7	
J16	Connector, Display PC	J0504
T1	Power Transformer	25295

FRONT PANEL ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
C1	Capacitor .1µf 500V	C1106
C2	Capacitor, 2Pf Disc	C0261
C3	Capacitor, 1Pf Disc	C0258
C4	Capacitor, 100Pf	C1075
C5	Capacitor, 10Pf	C1160
C14	Capacitor, 15Pf	C0528
C15	Same as C14	
I1	Indicator Lamp	I0074
I2	Lamp, Incandescent	I0050
I3	Same as I2	
I4	Same as I2	
I5	Same as I2	
J1	Connector BNC	J0260
J15	Connector BNC	J0342
R1	Resistor 1MΩ	R0962
R2	Resistor 910kΩ	R0359
R3	Resistor 10kΩ	R0766
R4	Resistor 270Ω	R0694
R5	Resistor 100kΩ	R0741
R6,S1,S3	Switch & Pot (5k)	25339
R7,S6,S8	Pot & Switch	R2367
R8	Resistor, 27Ω	R1548
S1,S3,R6	Same as R6	
S2	Switch, Toggle	S0149
S3	Same as R6	
S6,S8,R7	Same as R7	
S8,S6,R7	Same as R7	
S9	Switch P.B.	S0160
S12	Same as S2	

NOTE: All resistors are 1/4 watt, 5%, carbon composition unless other wise specified.

NOTE: All resistors are 1/4 watt, 5%, carbon composition unless other wise specified.

REAR PANEL ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
B1	Fan	H1786
C12	Capacitor, .01µf	C0556
C16	Capacitor, .005µf	C0221
C17	Same as C16	
F1	Fuse 1A Quick Acting	F0001
J3	Connector, BNC	J0260
J4	Same as J3	
J5	Same as J3	
J6	Same as J3	
Q1	Transistor, 2N4918	Q0268
Q2	Transistor, 2N4921	Q0267
Q3	Same as Q2	
Q4	Same as Q2	
Q5	Same as Q1	
S5	Slide Switch 4PDT	S0363
S10	Slide Switch DPDT	S0362
S11	Same as S10	

XTAL OSCILLATOR ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
CR1	Diode	19330
L1	Choke, 470µh	L0019
Q1	Transistor, 14092	14092
Q2	Same as Q1	
Q3	Same as Q1	
R1	Resistor, 1k	R0765
R2	Resistor, 6.8k	R0696
R3	Resistor, 470Ω	R1044
R4	Resistor, 680Ω	R1234
R5	Resistor, 1.2k	R0809
R6	Resistor, 47Ω	R0743
R8	Same as R3	
R9	Same as R3	
Y1	Oscillator	Y0023

SEVEN DIGIT PC ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
C1	Capacitor, .01µF, 500V Disc	C0423
C2	Same as C1	
C3	Same as C1	
C4	Same as C1	
C5	Capacitor, .05µF, 12V Disc	C0672
C6	Same as C5	
C7	Same as C5	
C8	Same as C5	
C9	Same as C5	
C10	Same as C5	
C11	Same as C5	
C12	Same as C5	
C13	Same as C5	
IC1	Integrated Circuit (SN7441N)	19707
IC2	Same as IC1	
IC3	Same as IC1	
IC4	Same as IC1	
IC5	Same as IC1	
IC6	Same as IC1	
IC7	Same as IC1	
IC8	Not Used	
IC9	Not Used	
IC10	Integrated Circuit (SN7075N)	25731
IC11	Same as IC10	
IC12	Same as IC10	
IC13	Same as IC10	
IC14	Same as IC10	
IC15	Same as IC10	
IC16	Same as IC10	
IC17	Not Used	
IC18	Not Used	
IC19	Not Used	
IC20	Integrated Circuit (SN7490N)	19711

SEVEN DIGIT PC ASSEMBLY (CON'T)

REF.	DESCRIPTION	SD PART NO.
IC21	Integrated Circuit (SN7090N)	25732
IC22	Same as IC21	
IC23	Same as IC21	
IC24	Same as IC21	
IC25	Same as IC21	
IC26	Not Used	
IC27	Not Used	
IC28	Integrated Circuit (SN7474N)	25241
IC29	Integrated Circuit (SN7410N)	19706
Q1	Transistor (2N3646)	Q0218
R1	Resistor 1/2W, 5% 39k	R0282
R2	Same as R1	
R3	Same as R1	
R4	Same as R1	
R5	Same as R1	
R6	Same as R1	
R7	Same as R1	
R8	Not Used	
R9	Not Used	
R10-R13	Resistor Newwork, BCD	27867
R14-R17	Same as R10-R13	
R18-R21	Same as R10-R13	
R22-R25	Same as R10-R13	
R26-R29	Same as R1 -R13	
R30-R33	Same as R10-R13	
R34-R37	Same as R10-R13	
R38-R41	Not Used	
R42-R45	Not Used	
R46	Resistor 1/4W, 5% 47Ω	R1044
R47	Resistor 1/4W, 5% 27Ω	R1548

TIME BASE PC ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
C1	Capacitor, .05 Disc., 12V	C0672
C2	Same as C1	
C3	Same as C1	
C4	Same as C1	
C5	Same as C1	
C6	Same as C1	
C7	Same as C1	
IC1	Integrated Circuit (SN7490)	19711
IC2	Same as IC1	
IC3	Integrated Circuit (SN15846)	19716
ICr	Same as IC1	
IC5	Same as IC3	
IC6	Same as IC1	
IC7	Same as IC3	
IC8	Same as IC1	
IC9	Same as IC3	
IC10	Same as IC1	
IC11	Same as IC3	
IC12	Same as IC1	
R1	Resistor, 1/4W, 5%, 5.6k	R0821
R2	Same as R1	
R3	Same as R1	
R4	Same as R1	
R5	Same as R1	

CONTROL & RESET PC ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
C1	Capacitor, .001µF	C0235
C2	Capacitor, 10µF, 6V	C1091
C3	Capacitor, 4.7µF, 35V	C0406
C4	Same as C1	

CONTROL & RESET PC ASSEMBLY (CON'T)

REF.	DESCRIPTION	SD PART NO.
C5	Capacitor, .01µF, 100V	C0556
C6	Capacitor, .1µF, 35V	C0806
C7	Same as C5	
C8	Same as C5	
C9	Capacitor, 56µF, 6V	C1090
C10	Capacitor, .05µF, 12V	C0672
C11	Same as C10	
C12	Same as C10	
C13	Same as C10	
C14	Same as C10	
C15	Same as C10	
CR1	DIODE 1N4151	CR0150
CR2	Not Used	
CR3	Same as CR1	
CR4	Same as CR1	
IC1	Integrated Circuit	19705
IC2	Same as IC1	
IC3	Integrated Circuit	25241
IC4	Same as IC1	
IC5	Integrated Circuit	19706
IC6	Same as IC1	
Q1	Transistor, 15840	15840
Q2	Transistor, 2N3646	Q0218
Q3	Transistor, 2N1671B	Q0084
Q4	Transistor, 2N3643	Q0179
Q5	Not Used	
Q6	Same as Q4	
Q7	Same as Q2	
R1	Resistor, 10k	R0766
R2	Resistor, 470Ω	R1044
R3	Resistor, 1k	R0765
R4	Resistor, 220k	R0967
R5	Same as R3	

CONTROL & RESET PC ASSEMBLY (CON'T)

REF.	DESCRIPTION	SD PART NO.
R6	Same as R1	
R7	Same as R1	
R8	Same as R3	
R9	Same as R1	
R10	Same as R1	
R11	Same as R1	
R12	Same as R2	
R13	Same as R3	
R14	Same as R2	
R15	Same as R3	
R16	Same as R2	
R17	Same as R1	
R18	Same as R1	
R19	Same as R3	
R20	Same as R3	
R21	Same as R2	
R22	Resistor, 5.6k	R0821
R23	Same as R1	
R24	Same as R22	
R25	Same as R3	
R26	Same as R22	
R27	Same as R1	
R28	Same as R1	

NOTE: All resistors are 1/4 watt, 5%, carbon composition unless other wise specified.

100 MHz AMP & DECADE PC ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
C1	Capacitor, .001µF, Disc	C0235
C2	Capacitor, .01µF, Disc	C0556
C3	Cxx	

100 MHz AMP & DECADE PC ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
C4	Cxx	
C5	Same as C2	
C6	Capacitor, 22pF	C0526
C7	Same as C2	
C8	Capacitor, 56pF	C0534
C9	Same as C2	
C10	Same as C2	
C11	Same as C2	
C12	Not Used	
C13	Capacitor, .05μF	C0672
C14	Same as C13	
C15	Same as C13	
S16	Same as C13	
C17	Same as C13	
C18	Same as C13	
C19	Same as C13	
C20	Same as C13	
C21	Same as C13	
C22	Same as C13	
C23	Same as C13	
C24	Same as C13	
C25	Same as C13	
C26	Cxx	
CR1	DIODE, 19330	19330
CR2	DIODE, 25287	25287
CR3	Same as CR1	
CR4	Same as CR1	
CR5	Same as CR1	
CR6	DIODE, 1N4151	CR0150
CR7	Same as CR6	
CR8	Same as CR6	
CR9	Same as CR2	
CR10	Same as CR6	
IC1	Integrated Circuit, MC1023P	25718

100 MHz AMP & DECADE PC ASSEMBLY (CON'T)

REF.	DESCRIPTION	SD PART NO.
IC2	Integrated Circuit, MC1027P	25719
IC3	Same as IC2	
IC4	Same as IC2	
IC5	Integrated Circuit, MC1018P	25717
IC6	Same as IC5	
IC7	Same as IC5	
IC8	Same as IC5	
IC9	Integrated Circuit, SN7400N	19705
L1	Coil, Reed Switch	L0147
L2	Same as L1	
L3	Same as L1	
L4	Choke, .15µH	L0069
L5	Same as L1	
L6	Ferrite Bead	H0654
Q1	Transistor, 2N5179	Q0269
Q2	Same as Q1	
Q3	Transistor	19420
Q4	Same as Q3	
Q5	Same as Q1	
Q6	Transistor, 2N3640	Q0178
Q7	Transistor, 2N4260	Q0272
Q8	Same as Q6	
Q9	Same as Q6	
Q10	Same as Q3	
Q11	Same as Q3	
Q12	Not Used	
Q13	Transistor, 14000	14000
Q14	Not Used	
Q15	Same as Q3	
Q16	Same as Q6	
Q17	Transistor, 2N3646	Q0218
Q18	Transistor, 14092	14092
R1	Resistor, 100Ω	R0966

100 MHz AMP & DECADE PC ASSEMBLY (CON'T)

REF.	DESCRIPTION	SD PART NO.
R2	Resistor, 2K POT	R2393
R3	Resistor, 220Ω	R0760
R4	Resistor, 120Ω	R1461
R5	Resistor, 100 POT	R2374
R6	Resistor, 470Ω	R1044
R7	Resistor, 390Ω	R0880
R8	Resistor, Temp. sensing, 390Ω	R2446
R9	Resistor, 270Ω	R0694
R10	Resistor, 47Ω	R0743
R11	Resistor, 330Ω	R0662
R12	Resistor, 180Ω	R1233
R13	Resistor, 820Ω	R0762
R14	Resistor, 82Ω	R1059
R15	Same as R3	
R16	Same as R6	
R17	Same as R1	
R18	Same as R6	
R19	Resistor, 1k	R0765
R20	Resistor, 47Ω, 1/8W, 5%	R1449
R21	Resistor, 22Ω, 1/8W, 5%	R1448
R22	Same as R11	
R23	Same as R5	
R24	Same as R21	
R25	Resistor, 910Ω	R1795
R26	Same as R13	
R27	Not Used	
R28	Same as R9	
R29	Resistor, 56Ω, 1/8W, 5%	R1833
R30	Resistor, 150Ω, 1/8W, 5%	R1442
R31	Not Used	
R32	Resistor, 160Ω	R1572
R33	Same as R32	

NOTE: All resistors are 1/4 watt, 5%, carbon composition unless other wise specified.

NOTE: All resistors are 1/4 watt, 5%, carbon composition unless other wise specified.

100 MHz AMP & DECADE PC ASSEMBLY (CON'T)

REF.	DESCRIPTION	SD PART NO.
R34	Resistor, 51Ω, 1/8W, 5%	R1832
R35	Same as R11	
R36	Same as R29	
R37	Same as R30	
R38	Not Used	
R39	Resistor, 560Ω	R0819
R40	Not Used	
R41	Same as R21	
R42	Same as R6	
R43	Same as R19	
R44	Resistor, 1.5k	R0783
R45	Resistor, 6.8k	R0696
R46	Same as R45	
R47	Same as R19	
R48	Resistor, 4.7k	R0892
R49	Same as R19	
R50	Resistor, 2.2k	R0749
R51	Same as R19	
R52	Same as R6	
R53	Rxx	
R54	Same as R9	
S1	Reed Switch, 15V	S0326
S2	Same as S1	
S3	Same as S1	

500 MHz PRESCALER PC ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
C1	Capacitor, .056µF, Chip	C1164
C2	Same as C1	
C3	Same as C1	
C4	Same as C1	
C6	Same as C1	

500 MHz PRESCALER PC ASSEMBLY (CON'T)

REF.	DESCRIPTION	SD PART NO.
C8	Same as C1	
C9	Same as C1	
C10	Same as C1	
C11	Same as C1	
C12	Same as C1	
C14	Same as C1	
C15	Same as C1	
C16	Same as C1	
C17	Capacitor, .01µF, 100V, Disc	C0556
C18	Same as C17	
C19	Same as C17	
C20	Same as C17	
C21	Same as C17	
C22	Same as C17	
C23	Same as C17	
C5	Capacitor, 15pF, Chip	C1163
C7	Same as C5	
C35	Same as C5	
C13	Not Used	
C24	Capacitor, .1µF, 10V, Disc	C0661
C25	Same as C24	
C26	Same as C24	
C27	Same as C24	
C28	Same as C24	
C29	Same as C24	
C30	Same as C24	
C31	Same as C24	
C32	Same as C24	
C33	Same as C24	
C34	Same as C24	
CR1	Diode, FD700	CR0356
CR2	Same as CR1	
CR3	Same as CR1	

500 MHz PRESCALER PC ASSEMBLY (CON'T)

REF.	DESCRIPTION	SD PART NO.
CR4	Same as CR1	
CR5	Same as CR1	
CR6	Same as CR1	
CR7	Diode, TD254A	CR0360
CR8	Diode, TD253B	CR0357
CR11	Same as CR8	
CR12	Diode, 19330	19330
CR13	Same as CR12	
CR14	Not Used	
CR15	Not Used	
CR9	Matched Pair TD253B Diodes	27960
CR10	Same as CR9	
IC1	Integrated Circuit, SN15846N	19716
IC2	Integrated Circuit, 2N7473N	19709
L7	Choke, 05µH	L0159
L11	P/O Peaking Network	
L12	Ferrite Bead	H0654
L13	Same as L12	
Q1	Transistor, 2N5179	Q0269
Q2	Same as Q1	
Q3	Same as Q1	
Q4	Same as Q1	
Q5	Not Used	
Q6	Transistor, 2N4260	Q0272
Q7	Transistor, 2N3640	Q0178
Q8	Transistor, 2N3646	Q0218
Q9	Same as Q1	
Q10	Same as Q1	
Q11	Same as Q8	
R1	Resistor, 390Ω, 5% 1/2W	R0322
R2	Same as R1	
R3	Same as R1	
R4	Same as R1	

NOTE: All resistors are 1/4 watt, 5%, carbon composition unless other wise specified.

500 MHz PRESCALER PC ASSEMBLY (CON'T)

REF.	DESCRIPTION	SD PART NO.
R5	Same as R1	
R6	Same as R1	
R7	Resistor, 1.5k	R0783
R8	Same as R7	
R9	Resistor, 820Ω	R0762
R10	Resistor, 27Ω	R1825
R11	Same as R7	
R12	Resistor, 82Ω, 1/8W, 5%	R1745
R13	Same as R9	
R14	Same as R10	
R15	Same as R7	
R16	Same as R12	
R17	Same as R9	
R18	Same as R10	
R19	Same as R7	
R20	Resistor 39Ω, 5% 1/8W	R1829
R21	Resistor, 150Ω	R0983
R22	Resistor, 200Ω, Potentiometer	R2394
R23	Same as R10	
R24	Same as R10	
R25	Resistor 200Ω, POT	R2425
R26	Resistor 82Ω	R1059
R27	Resistor, 24Ω, 5%, 1/8W	R1824
R28	Resistor, 10Ω, 5%, 1/8W	R1866
R29	Resistor, 56Ω, 5%, 1/8W	R1833
R30	Same as R29	
R31	Resistor, 100Ω, 5%, 1/8W	
R32	Same as R31	
R33	Resistor, 12Ω, 5%, 1/8W	R1840
R34	Same as R12	
R35	Same as R20	
R36	Resistor, 330Ω	R0662
R37	Same as R22	

500 MHz PRESCALER PC ASSEMBLY (CON'T)

REF.	DESCRIPTION	SD PART NO.
R38	Resistor, 1.2k	R0809
R39	Resistor, 47Ω, 5%, 1/8W	R1449
R40	Resistor, 160Ω	R1572
R41	Same as R40	
R42	Same as R20	
R43	Resistor, 360Ω	R1571
R44	Same as R20	
R45	Resistor, 220Ω	R0760
R46	Same as R38	
R47	Same as R33	
R48	Same as R45	
R49	Resistor, 39Ω	R1552
R50	Same as R7	
R51	Resistor, 10k	R0766
R52	P/O Peaking Network	
R53	Resistor, 120Ω	R1461
R54	Resistor 39Ω, TM 1/8	R2447
R55	Resistor 200Ω	R0736
R56	Resistor, 470Ω	R1044
R57	Same as R56	
R58	Resistor 100k	R0741
	Peaking Network	27927

NOTE: All resistors are 1/4 watt, 5%, carbon composition unless other wise specified.

100 MHz INPUT PC ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
C1	Cap, .001μF, 1kV, Disc	C0235
C2	Same as C1	
C3	Cap, .01μF, 150V, Disc	C0233
C4	Cap, .05μF, 12V, Disc	C0672
C5	Same as C4	
C6	Same as C1	

100 MHz INPUT PC ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
C7	Same as C1	
C8	Same as C1	
C9	Same as C3	
C10	Same as C3	
C11	Same as C4	
C12	Same as C4	
C13	Cap, 60µF, 50V, Tant	C0511
C14	Same as C3	
C15	Same as C13	
C16	Same as C3	
C17	Same as C4	
C18	Cap, 100µF, 10V, Tant	C0369
C19	Same as C4	
C20	Same as C4	
C21	Cap, Cxxx	
C22	Cap, Cxxx	
C23	Cap, 100pF Mica	C1156
CR1	Diode, 1N4151	CR0150
CR2	Same as CR1	
CR3	Diode, 1N937	CR0109
CR4	Same as CR3	
CR5	Diode, 1N751A	CR0095
L1	Inductor, 100µh	L0073
Q1	Xistor, TIS34	Q0244
Q2	Xistor, 2N3546	Q0192
Q3	Xistor, 2N3959	Q0200
Q4	Xistor, 2N4342	Q0243
Q5	Same as Q3	
Q6	Same as Q2	
Q7	Xistor, 2N3640	Q0178
Q8	Xistor, 2N3251	Q0174
Q9	Xistor, Matched Pair	27775
Q10	Same as Q7	

NOTE: All resistors are 1/4 watt, 5%, carbon composition unless other wise specified.

100 MHz INPUT PC ASSEMBLY"

REF.	DESCRIPTION	SD PART NO.
Q11	Xistor, 2N3565	Q0237
Q12	P/O Q9	
Q13	Xistor, 14092	14092
Q14	Same as Q13	
Q15	Same as Q13	
Q16	Same as Q13	
Q17	Same as Q13	
R1	Res, 10k, 5%, 1/2W	R0292
R2	Res, 220Ω	R0760
R3	Same as R2	
R4	Res, 4.7k	R0892
R5	Res, 1k	R0765
R6	Same as R2	
R7	Same as R2	
R8	Same as R2	
R9	Res, 2.2k	R0749
R10	Same as R9	
R11	Res, 100k	R0741
R12	Res, 6.8k	R0696
R13	Same as R5	
R14	Same as R2	
R15	Res, 120Ω	R1461
R16	Res, 10k	R0766
R17	Same as R16	
R18	Same as R16	
R19	Res, 470Ω	R1044
R20	Same as R12	
R21	Same as R19	
R22	Res, 910k	R2312
R23	Same as R1	
R24	Same as R12	
R25	Res, 22k	R0768
R26	Res, 820Ω	R0762

NOTE: All resistors are 1/4 watt, 5%, carbon composition unless other wise specified.

100 MHz INPUT PC ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
R27	POT, 5K	R2187
R28	Res, 220k	R0967
R29	Same as R28	
R30	Not Used	
R31	Res, 82k	R0784
R32	Same as R5	
R33	Same as R5	
R34	POT, 10k	R2383
R35	Same as R4	
R36	Same as R19	
R37	Same as R19	
R38	Same as R19	
R39	Same as R5	
R40	Same as R5	
R41	Res, 1.8k	R0959
R42	Res, 1.5k	R0783
R43	Res, 5.6k	R0821
R44	Res, 47Ω	R0743
R45	Res, 3.3k	R0742
R46	Res, 30k	R0715
R47	Res, 3.9k	R0939
R48	Same as R47	
R49	Same as R11	
R50	Res, 2k, POT	R2382

POWER ASSEMBLY PC ASSEMBLY

REF.	DESCRIPTION	SD PART NO.
C102	Capacitor, 1μf	C0314
C103	Capacitor, .1μf, 100V	C0786
CR101	Diode 1N4005	CR0284
CR102	Same as CR101	
CR103	Same as CR101	
CR104	Same as CR101	

NOTE: All resistors are 1/4 watt, 5%, carbon composition unless other wise specified.

POWER SUPPLY PC ASSEMBLY (CON'T)

REF.	DESCRIPTION	SD PART NO.
CR105	Same as CR101	
CR106	Same as CR101	
CR107	Same as CR101	
CR108	Same as CR101	
CR109	Same as CR101	
CR110	Same as CR101	
CR114	Diode, Zener, 1N752-A	CR0064
CR115	Diode, 1N4370, 2.4V	CR0309
CR117	Diode, Zener, 1N966B	CR0213
CR118	Same as CR117	
CR119	Same as CR114	
CR120	Same as CR115	
CR122	Diode, 1N4719	CR0251
CR123	Same as CR122	
R101	Resistor, 180k, 1/2W	R0283
R110	Resistor, 1.2k,	R0809
R111	Resistor, 390Ω	R0880
R112	Resistor, 1k	R0765
R113	Resistor, 15Ω	R1607
R114	Resistor, 100Ω	R0966
R115	Resistor, 150Ω	R0983
R116	Resistor, 100Ω, POT, PC (T-100)	R2376
R117	Resistor, 47Ω	R0743
R118	Resistor, 47Ω, TM 1/4	R2320
R119	Resistor, 470Ω	R1044
R120	Same as R119	
R121	Same as R111	
R122	Same as R110	
R123	Resistor, 4.7k	R0892
R124	Same as R113	
R125	Same as R112	
R126	Same as R117	
R127	Same as R116	
R128	Same as R115	
R129	Same as R118	

SECTION 7

ADDENDUM

This addendum is to be included in all Instruction Manuals which describe an SD 7015 which incorporates the "E" option -- an extra readout numerical indicator tube. This modification necessitates the following changes in the Acceptance Test Procedure (SD 7015 Manual, Section 4.5):

Indication 1g should read, "Display illuminates, reads .00000001 ±1μsec. A 1MHz 3V P-P signal is available at the 1MHz OUT connector."

Indication 1h should be "Display reads 0000001.0 ±0.1μs."

Indication 1i should be "Display reads 000001.00 ±0.01μs."

Indication 1j should be "Display reads 00001.000 ±0.001μs."

Indication 1k should be "Display reads 0001.0000 ±0.0001μs."

Indication 1l should be "Display reads 001.00000 ±0.00001μs."

Indication 3a should be "Display reads 1000.0000 ±0.0001kHz."

Indication 3b should be "Display reads 01000.000 ±0.001kHz."

Indication 3c should be "Display reads 001.00000 ±0.00001kHz."

Indication 3d should be "Display reads 0001.0000 ±0.0001MHz."

Indication 6e should be "Display reads 000005.00 sec, but legend and decimal point are not applicable in RATIO."

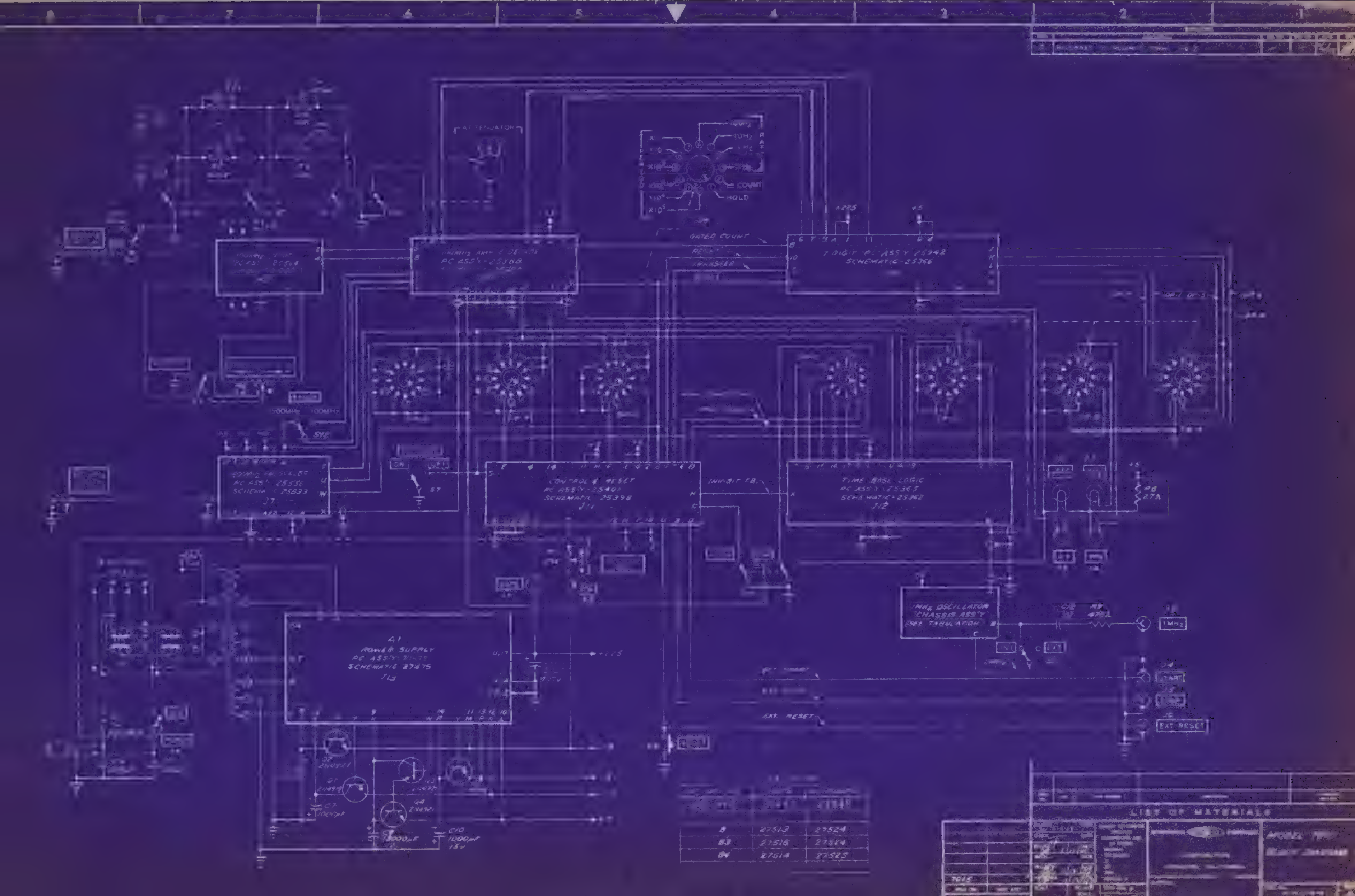
Indication 6f should be "Display reads 000000.00 sec."

Indication 7a should be "Display indicates 00000000."

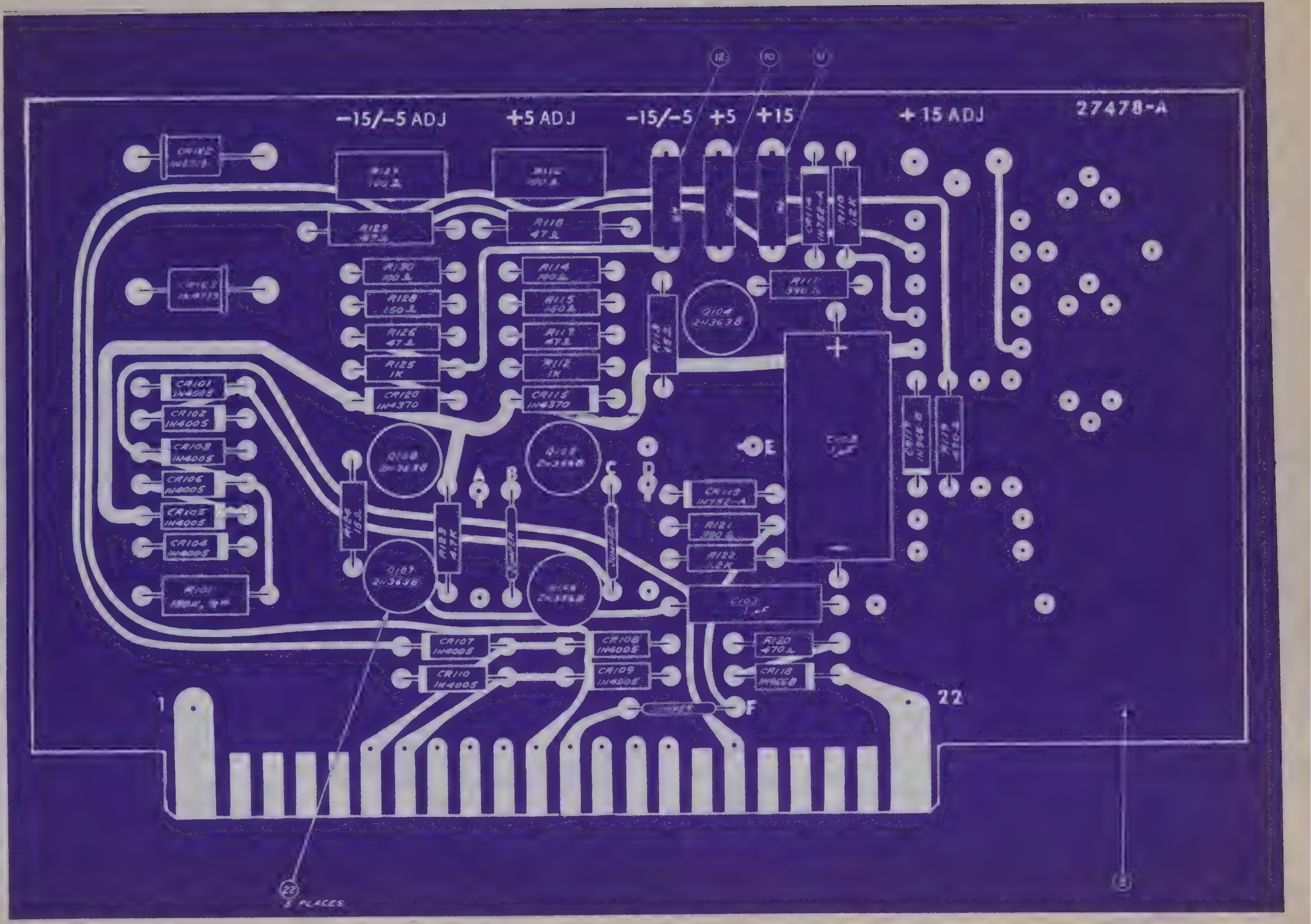
Indication 7b should be "Display should register a count each time the control passes through zero going from minus to plus."

Indication 9c should be "Display should read 100.00000 ±0.00001MHz."

Indication 9e should be "Display should read 500.00000 ±0.00001MHz."


8
7
6
5
4
3
2
1
ATTENUATOR
X1
X10
X10²
X10³
X10⁴
X10⁵
100MHz
10MHz
1MHz
RATE
COUNT
HOLD
PERIOD
GATED COUNT
RESET
TRANSFER
+225
+5
100MHz AMP & DECADE
PC ASS'Y - 25388
7 DIGIT PC ASS'Y 25942
SCHEMATIC - 25366
500MHz
100MHz
S1E
500MHz PRESCALER
PC ASS'Y 25536
SCHEMATIC 25533
J7
ON
OFF
S7
CONTROL & RESET
PC ASS'Y - 25401
SCHEMATIC 25398
J11
INHIBIT T.B.
TIME BASE LOGIC
PC ASS'Y - 25365
SCHEMATIC - 25362
J12
R8
27Ω
1MHz OSCILLATOR
CHASSIS ASS'Y
SEE TABULATION
C12
R9
47Ω
1MHz
INT
EXT
EXT START
EXT STOP
EXT RESET
J4
J5
J6
START
STOP
EXT RESET
A1
POWER SUPPLY
PC ASS'Y
SCHEMATIC 27475
J13
+225
Q2
2N4921
Q1
2N4919
Q4
2N4921
C7
1000μF
C9
1000μF
C10
1000μF
15V
LIST OF MATERIALS
7015

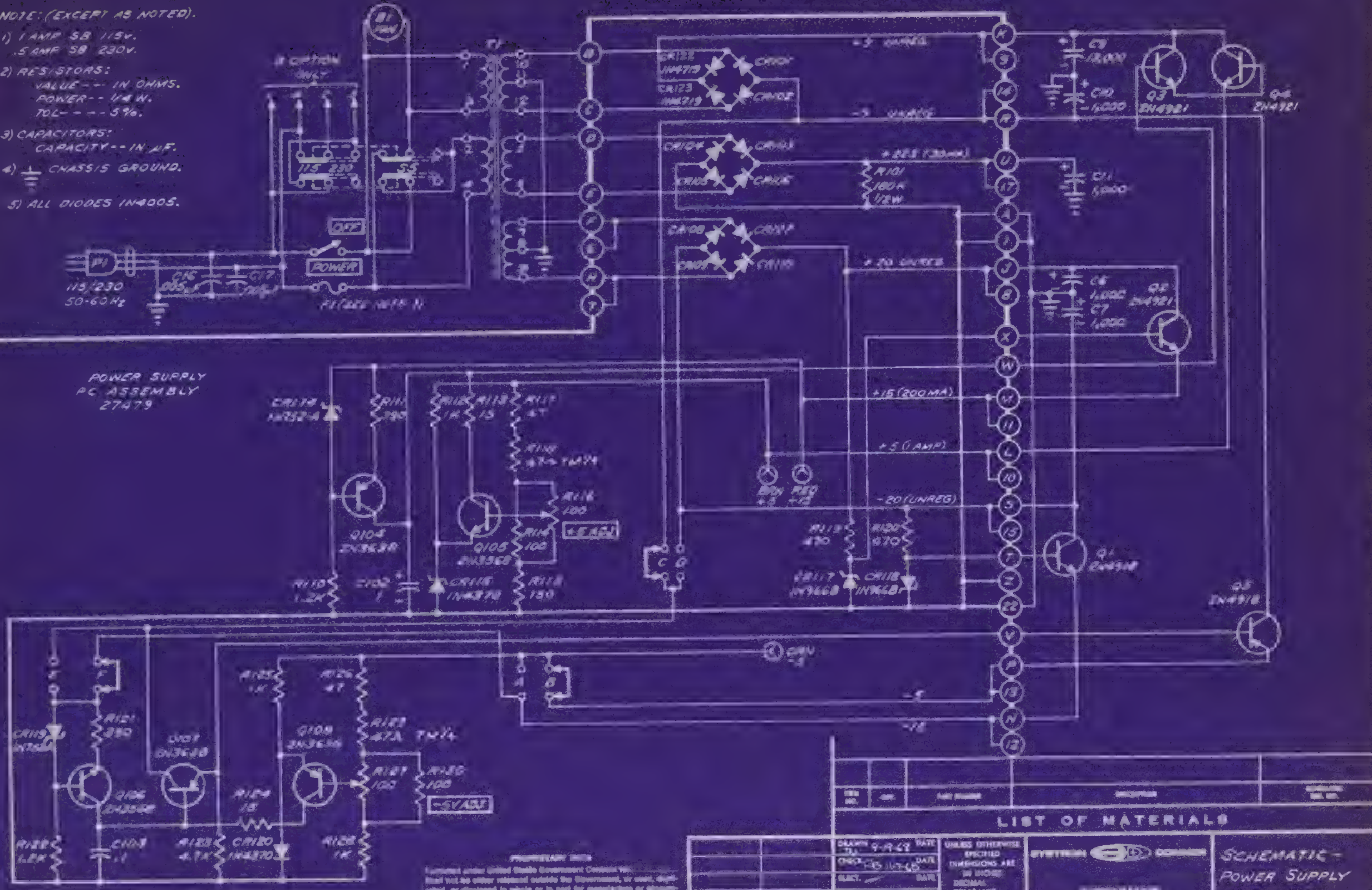
B	27513	27524
B3	27515	27524
B4	27514	27525



27478-A
−15/−5 ADJ
+5 ADJ
−15/−5
+5
+15
+ 15 ADJ
12
10
11
R129 47Ω
R118 47Ω
R130 100Ω
R128 150Ω
R126 47Ω
R125 1K
CR120 1N4370
R114 100Ω
R115 150Ω
R117 47Ω
R112 1K
CR115 1N4370
CR116 1N752-A
R110 1.2K
R117 390Ω
Q104 2N3638
+
CR111 1N966-B
R119 470Ω
CR101 1N4005
CR102 1N4005
CR103 1N4005
CR106 1N4005
CR105 1N4005
CR104 1N4005
R101
Q108 2N3638
Q102 2N3638
Q107 2N3638
Q105 2N3638
R124 15Ω
R123 4.7K
JUMPER
JUMPER
A
B
C
D
E
F
CR113 1N752-A
R121 390Ω
R122 1.2K
C103 1 μF
CR107 1N4005
CR110 1N4005
CR108 1N4005
CR109 1N4005
R120 470Ω
CR118 1N966B
JUMPER
1
22
22
5 PLACES

NOTE: (EXCEPT AS NOTED).

1) 1 AMP SB 115V.
   .5 AMP SB 230V.
2) RESISTORS:
   VALUE --- IN OHMS.
   POWER -- 1/4 W.
   TOL ---- 5%.
3) CAPACITORS:
   CAPACITY -- IN µF.
4) ⏚ CHASSIS GROUND.
5) ALL DIODES 1N4005.


B1 FAN
T1
115 230
SS
OFF
POWER
P1
115/230
50-60 Hz
C16 .005µF
C17 .005µF
F1 (SEE NOTE 1)
CR122 1N4719
CR123 1N4719
CR101
CR102
CR104
CR103
CR105
CR106
CR108
CR107
CR109
CR110
+5 UNREG
-5 UNREG
+225 (30MA)
R101 180K 1/2W
+20 UNREG
+15 (200MA)
+5 (1 AMP)
-20 (UNREG)
C9 12,000
C10 1,000
C11 1,000
C6 1,000
C7 1,000
Q3 2N4921
Q4 2N4921
Q2 2N4921
Q1 2N4918
Q5 2N4918
CR114 1N752A
R111 390
R112 1K
R113 15
R117 47
R110 47.5 TMY4
R116 100
R114 100
+5 ADJ
Q104 2N3638
Q105 2N3568
R118 150
R110 1.2K
C102 1
CR115 1N4370
BDY
REG
+5
+15
R119 430
R120 470
CR117 1N966B
CR118 1N966B
C
D
A
B
CRV -5
-5
-12
R125 1K
R126 47
R121 390
Q107 D13618
Q108 2N3638
R123 47Ω TMY4
R127 100
R130 100
-5V ADJ
R124 15
CR119 1N752
Q106 2N3568
R122 1.2K
C118 .1
R128 4.7K
CR120 1N4370
R126 1K
POWER SUPPLY
P.C. ASSEMBLY
27479

LIST OF MATERIALS

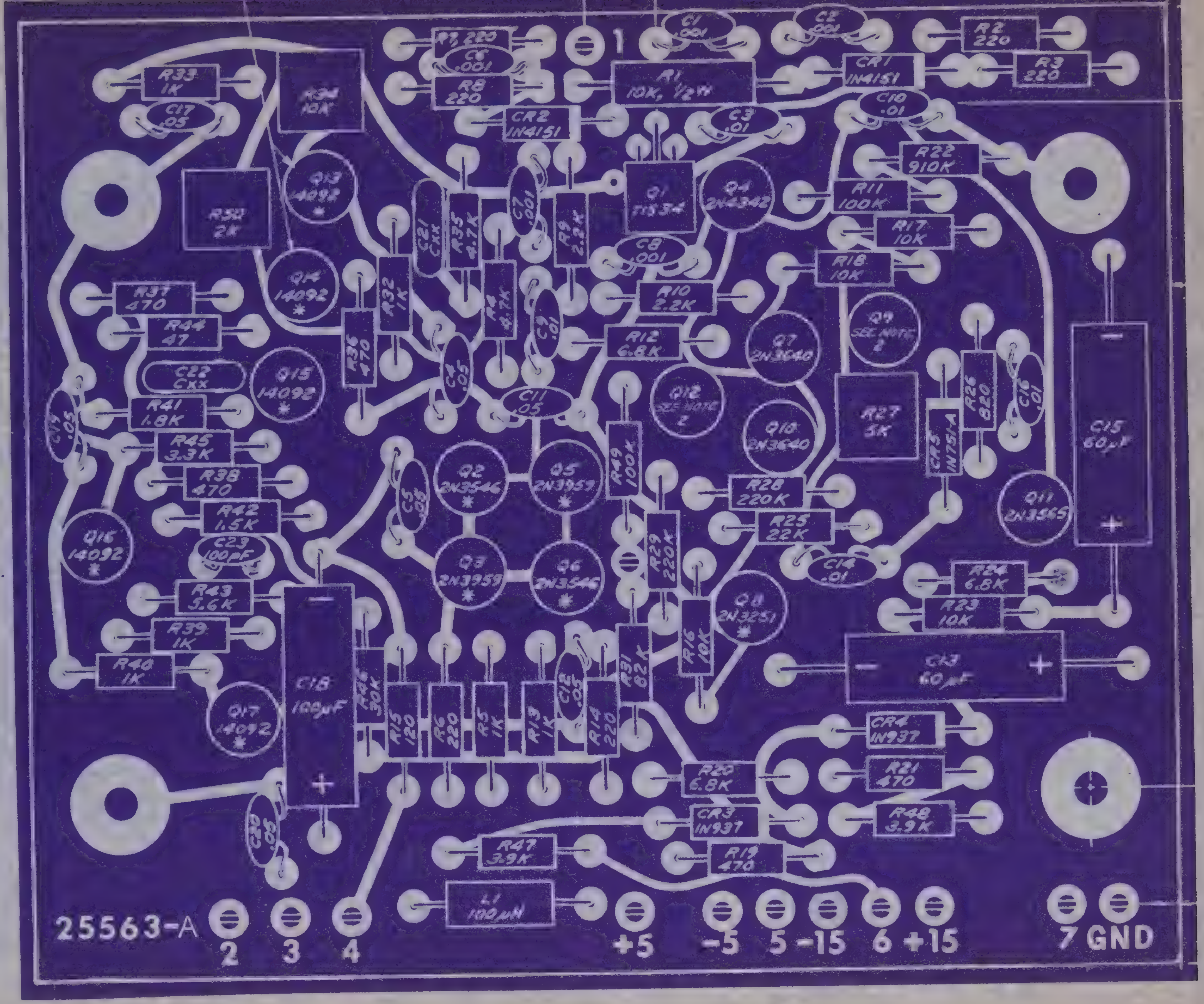
7000	27479
USED ON	NEXT ASSY
APPLICATION	

DRAWN T.L. 9-19-68
CHECK R.B. 11-7-68
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
SCALE —
DO NOT SCALE DRAWING
DWG SIZE C
SH 1 OF 1

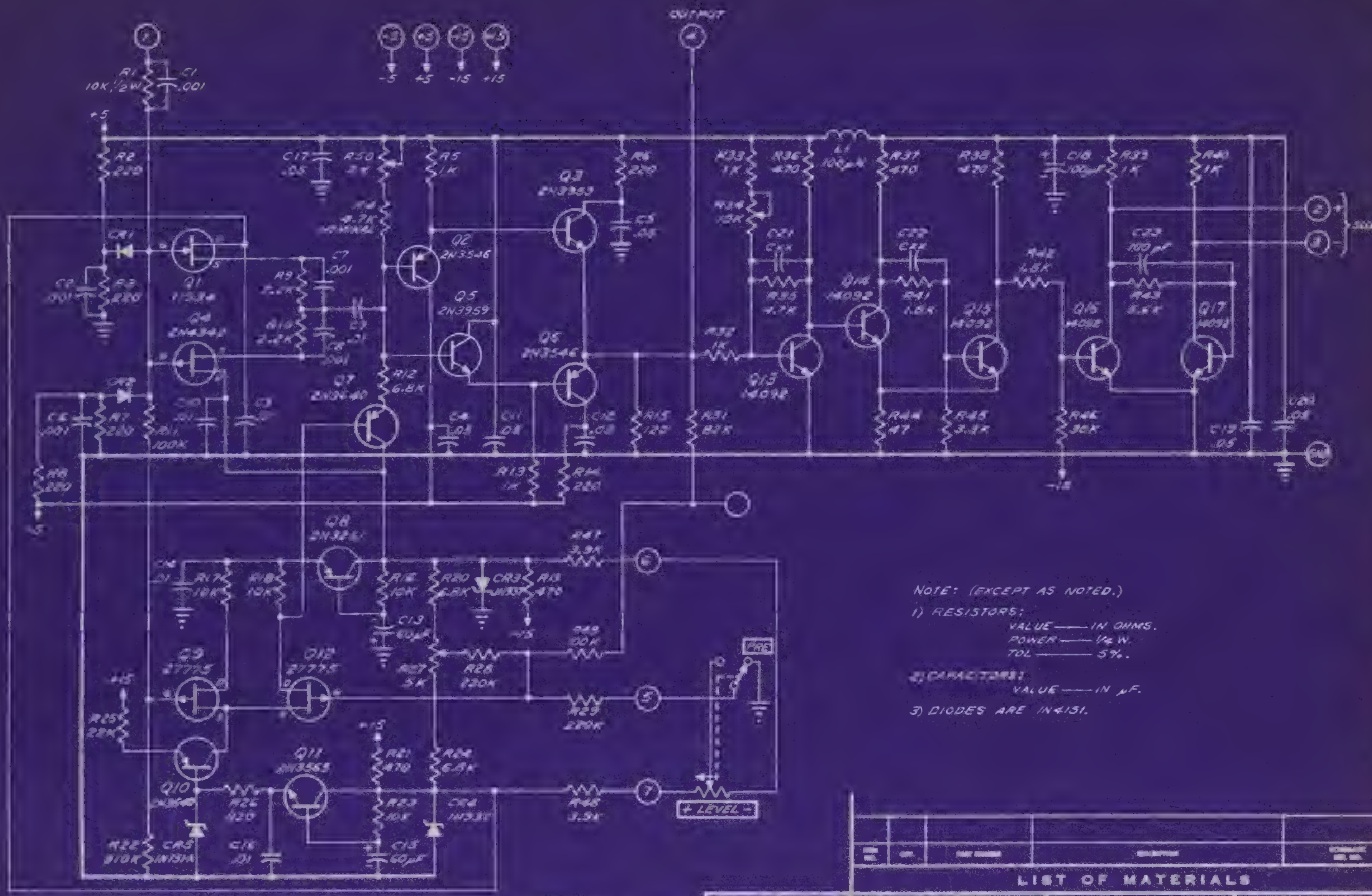
SYSTRON DONNER CORPORATION
CONCORD, CALIFORNIA

SCHEMATIC -
POWER SUPPLY
P.C. ASSY

DWG NO. 27475
A


R7, 220
C6 .001
R8 220
1
C1 .001
R1 10K, 1/2W
C2 .001
CR1 1N4151
R2 220
R3 220
R33 1K
C17 .05
R34 10K
CR2 1N4151
C3 .01
C10 .01
R22 910K
R50 2K
Q13 14092 *
C21 CXX
R35 4.7K
C7 .001
R9 2.2K
Q1 TIS34
Q4 2N4342
R11 100K
R17 10K
C8 .001
R18 10K
Q14 14092 *
R32 1K
R4 4.7K
R10 2.2K
R37 470
R44 47
R36 470
C9 .01
R12 6.8K
Q7 2N3640
Q9 SEE NOTE 2
C22 CXX
Q15 14092 *
C4 .05
Q12 SEE NOTE 2
R26 820
C16 .01
C19 .05
R41 1.8K
C11 .05
R27 5K
CR5 1N751-A
C15 60µF
R45 3.3K
Q10 2N3640
R38 470
Q2 2N3546 *
Q5 2N3959 *
R49 100K
R28 220K
Q11 2N3565
C5 .05
R42 1.5K
R25 22K
Q16 14092 *
C23 100pF
Q3 2N3959 *
Q6 2N3546 *
R29 220K
C14 .01
R24 6.8K
R43 5.6K
R23 10K
R39 1K
Q8 2N3251 *
R16 10K
R31 82K
C13 60µF
R40 1K
C18 100µF
R46 30K
R15 120
R6 220
R5 1K
R13 1K
C12 .05
R14 220
Q17 14092 *
CR4 1N937
R20 6.8K
R21 470
C20 .05
CR3 1N937
R48 3.9K
R47 3.9K
R19 470
L1 100µH
25563-A
2
3
4
+5
-5
5
-15
6
+15
7
GND

A	RELEASED TO RECORDS FROM XP-1	—	—	11/30/65	


OUTPUT
-5
+5
-15
+15
R1 10K ½W
C1 .001
R2 220
CR1
C2 .001
R3 220
Q1 U1834
Q4 2N4342
CR2
C6 .001
R7 220
R8 220
C10 .01
R11 100K
C3 .01
R9 2.2K
R10 2.2K
C7 .001
C9 .01
C8 .001
C17 .05
R50 2K
R4 4.7K NOMINAL
R5 1K
Q2 2N3546
Q5 2N3959
Q7 2N3640
R12 6.8K
C4 .05
C11 .05
Q3 2N3563
R6 220
C5 .05
Q6 2N3546
C12 .05
R13 1K
R14 220
R15 120
R31 82K
R32 1K
R33 1K
R34 10K
R36 470
C21 CAX
R35 4.7K
L1 100µH
Q13 M092
Q14 M092
R37 470
C22 CAX
R41 1.8K
R44 47
R45 3.3K
R38 470
Q15 M092
R42 1.8K
R46 30K
C18 100µF
R39 1K
C23 100µF
R43 3.3K
Q16 M092
Q17 M092
R40 1K
C19 .05
C20 .05
SLOPE
Q8 2N3251
C14 .01
R17 10K
R18 10K
R16 10K
R20 6.8K
CR3 IN4151
R19 470
C13 60µF
R47 3.3K
R49 100K
R27 5K
R28 220K
R29 220K
Q9 2N7775
Q12 2N7775
PRE
R25 22K
Q10 2N3640
Q11 2N3565
R26 820
R21 470
R23 10K
R24 6.8K
CR4 IN5337
R48 3.9K
LEVEL
R22 910K
CR5 IN5151A
C16 .01
C15 60µF
1
2
3
4
5
6
7

NOTE: (EXCEPT AS NOTED.)

1) RESISTORS:
VALUE —— IN OHMS.
POWER —— ¼ W.
TOL —— 5%.

2) CAPACITORS:
VALUE —— IN µF.

3) DIODES ARE IN4151.

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION	SCHEMATIC REF. NO.

LIST OF MATERIALS

PROPRIETARY DATA

Furnished under United States Government Contract No. Shall not be either released outside the Government, or used, duplicated, or disclosed in whole or in part for manufacture or procurement, without the written permission of Systron-Donner Corporation except for: (1) emergency repair or overhaul work by or for the Government, where the item or process concerned is not otherwise reasonably available to enable timely performance of the work; or (2) release to a foreign government, as the interests of the United States may require; provided that in either case the release, use, duplication or disclosure hereof shall be subject to the foregoing limitations. This legend shall be marked on any reproduction hereof in whole or in part.

7018	25564
7015	25564
USED ON	NEXT ASSY
APPLICATION	

DRAWN JN 11-3-65 DATE
CHECK RB 11-5-65 DATE
ELECT 11-5-65 DATE
MECH RB 11-5-65 DATE
PROJ 11-5-65 DATE
APPR 11-5-65 DATE
SCALE —
DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
DECIMAL TOLERANCE
.X
.XX —
.XXX
ANGLES ±
DWG SIZE C
SH 1 OF 1

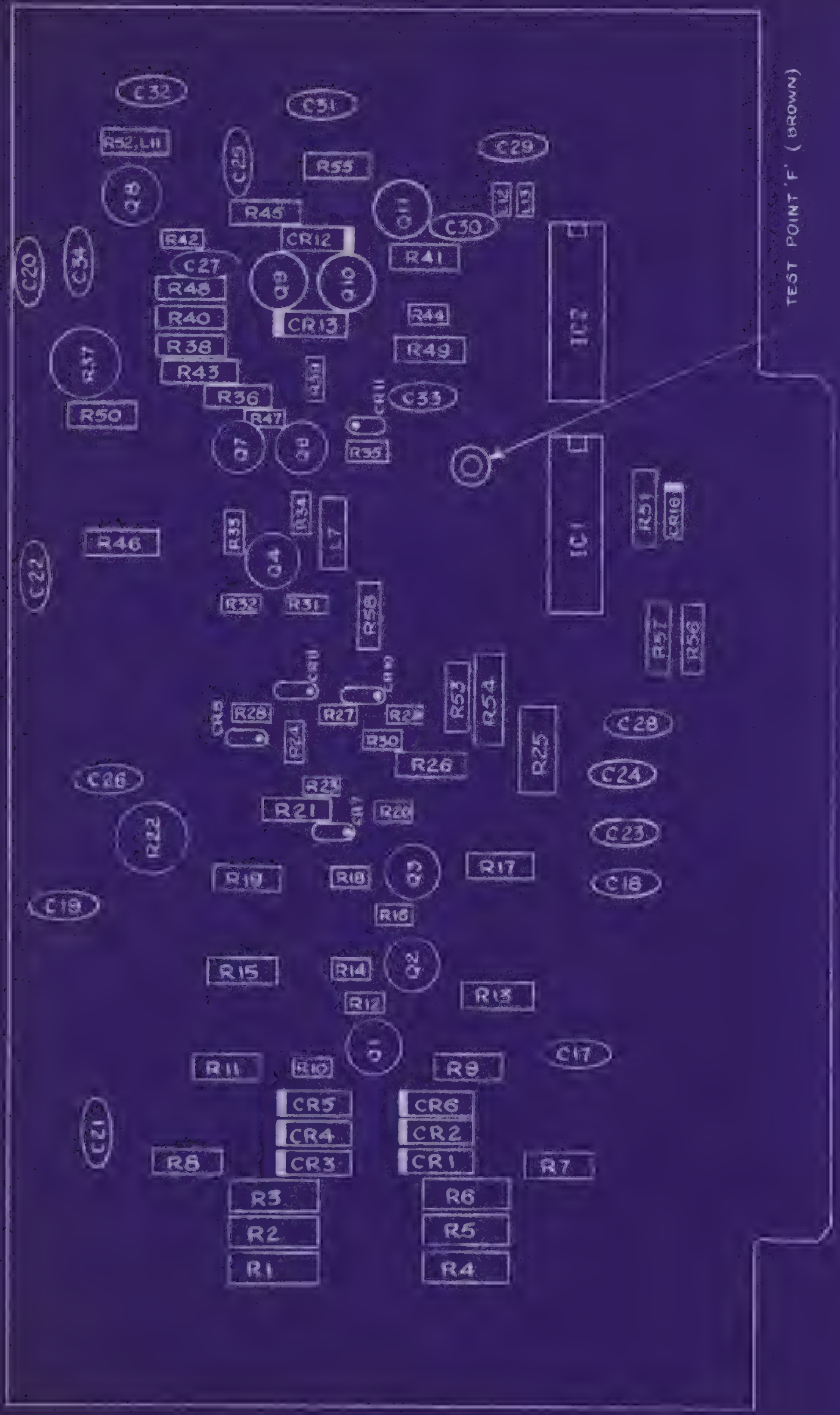
SYSTRON-DONNER
CORPORATION
CONCORD, CALIFORNIA

MATERIAL —

SCHEMATIC —
100 MHz INPUT
PC ASSEMBLY

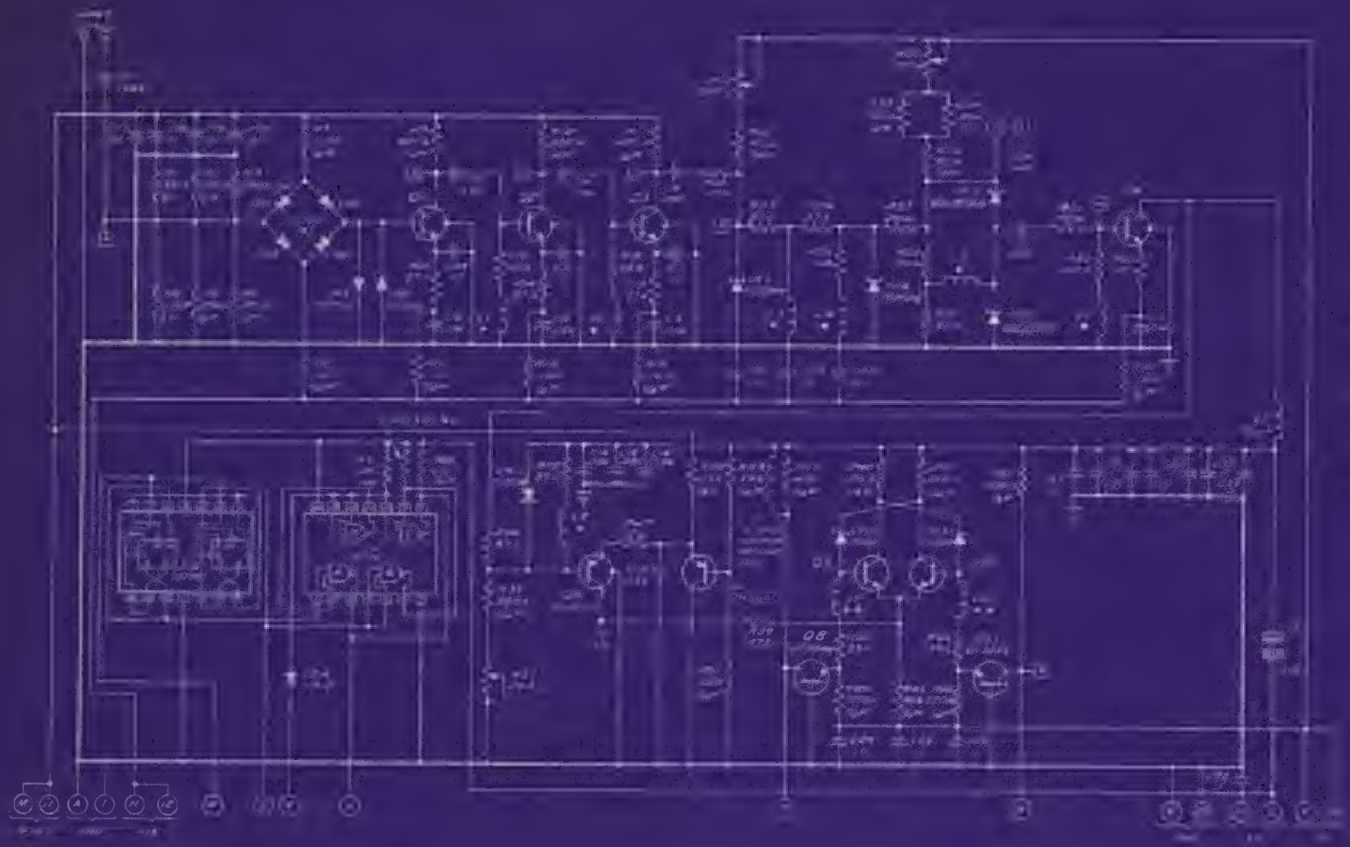
DWG NO. 25561
REV A

25561


TEST POINT 'F' (BROWN)

C32
C31
C29
R52, L11
C25
R55
Q8
R45
Q11
L12
L13
C30
R42
CR12
R41
C20
C34
C27
Q9
Q10
R48
R40
CR13
R44
IC2
R38
R37
R49
R43
R39
CR11
R36
C33
R50
R47
Q7
Q6
R35
IC1
R51
CR16
R46
R33
R34
L7
Q4
C22
R32
R31
R58
R57
R56
CR14
CR15
R53
R54
CR8
R28
R27
R29
R24
R30
R25
C28
R26
C26
R23
C24
R21
CR7
R20
R22
C23
R19
R18
Q3
R17
C18
C19
R16
R15
R14
Q2
R12
R13
Q1
R11
R10
R9
C17
CR5
CR6
CR4
CR2
C21
R8
CR3
CR1
R7
R3
R6
R2
R5
R1
R4

A	A RELEASED FROM KRS
	REVISED PER ECO C29 & 10 WERE TD253B



NOTES: EXCEPT AS NOTED

1) RESISTORS:
POWER

VALUES LESS THAN ONE IN pF
MORE

3) TRANSISTORS ARE 2N5179

4) * - INDICATED CHOKES ARE PART OF PC PATTERN.
** - INDICATED CHOKES ARE RESISTOR [illegible]
L12 & L13 ARE FERRITE BEADS.

5) [A] = TEST POINTS REFERRED TO IN ALIGNMENT
PROCEEDURE 27782

6) MATCHED PAIR SD 27960

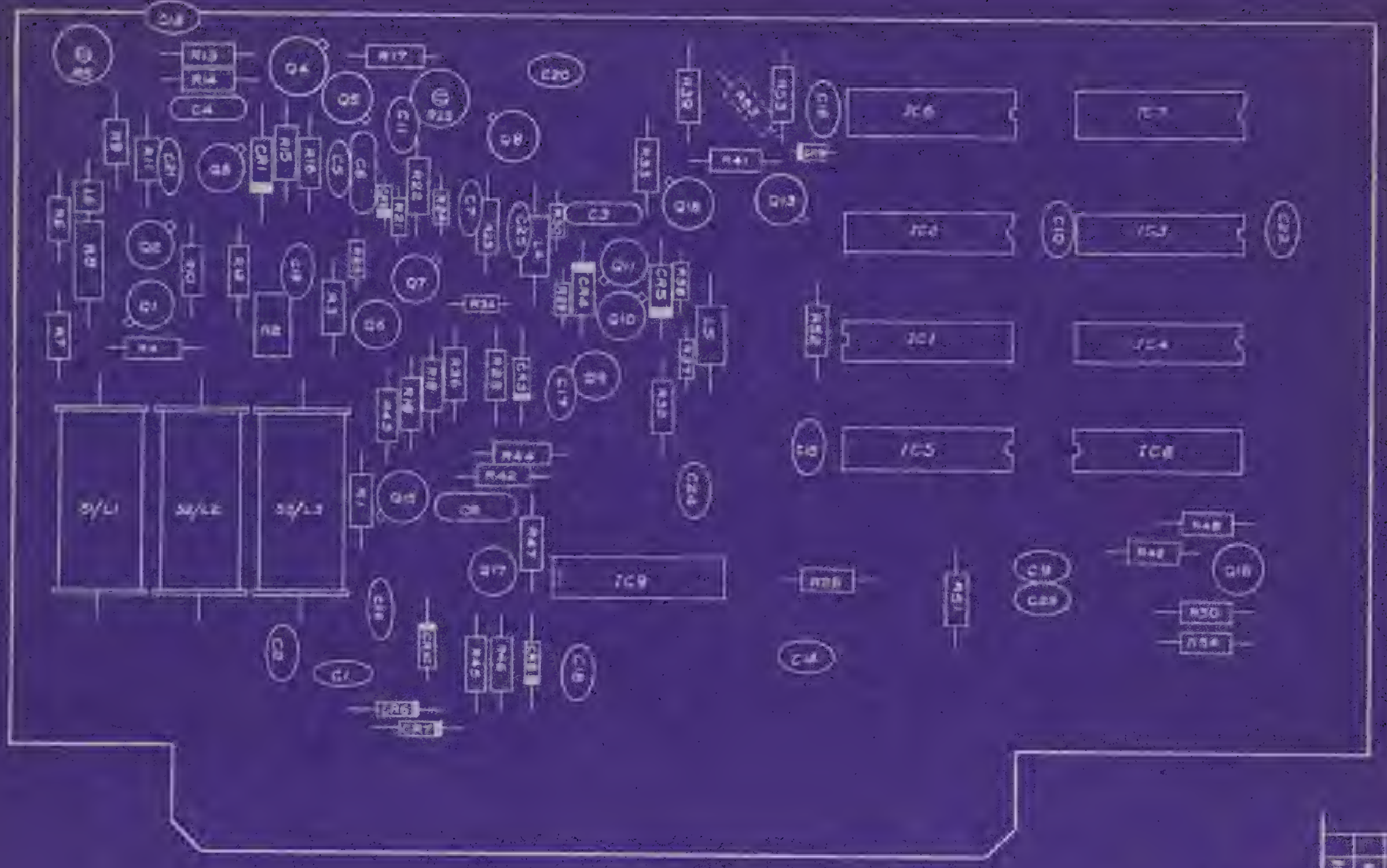
LIST OF MATERIALS

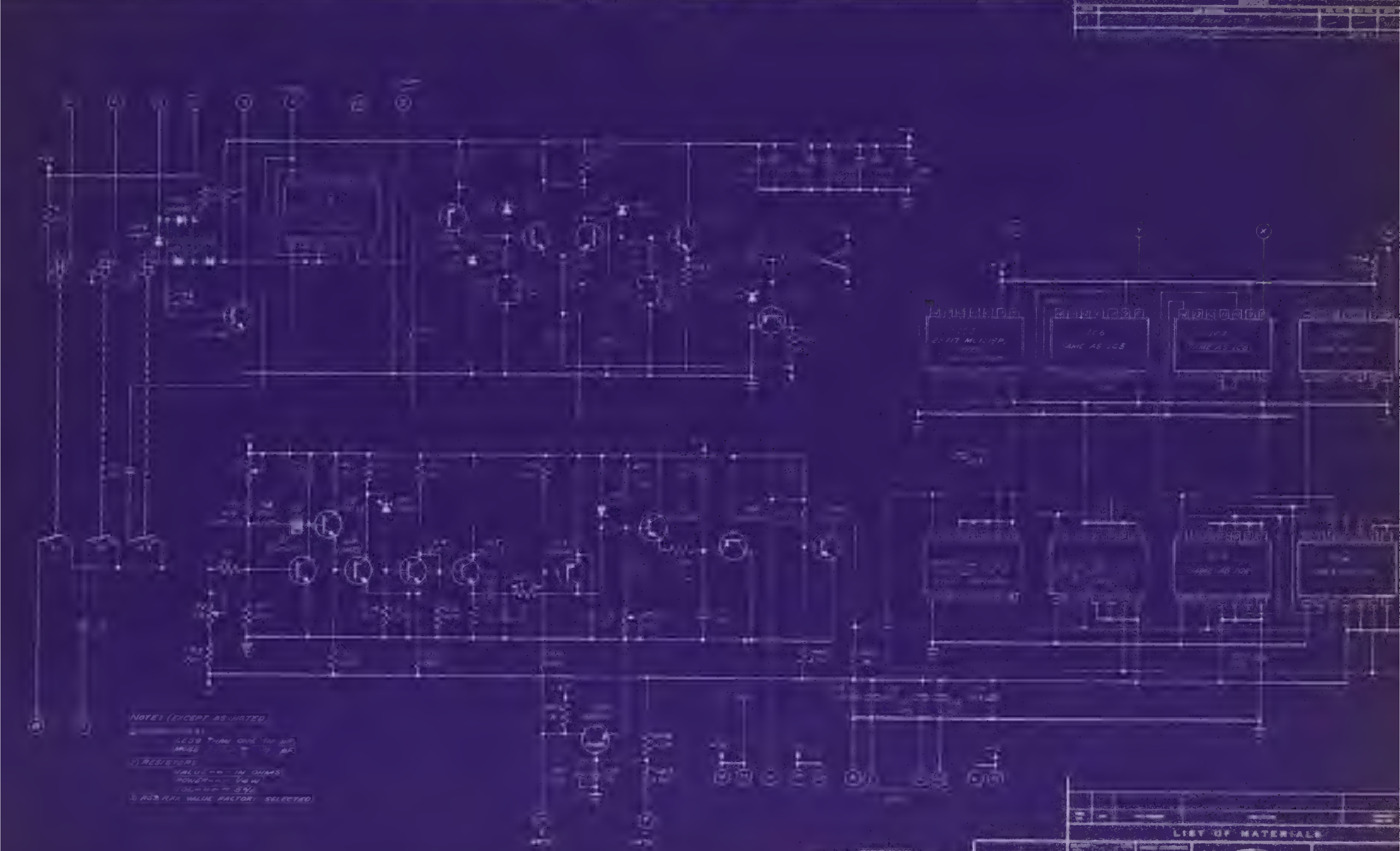
CORPORATION
CONCORD CALIFORNIA

SCHEMATIC
PRESCALER
PC ASSEMBLY

25531

C


Q12
R13
R14
C4
Q4
R17
Q5
C11
R25
C20
Q9
R8
R11
C21
Q3
CR1
R15
R16
C5
C6
R22
R21
R24
C7
R23
C25
L4
R39
R53
R52
R33
R41
C16
CR9
C3
Q18
Q13
R6
L6
R9
Q2
R10
R12
C19
R35
Q7
R34
CR4
Q11
CR5
R38
L5
R37
Q1
R7
R4
R2
R1
Q6
R43
R19
R18
R36
R28
C13
C17
Q9
R32
R44
R42
Q15
C8
R47
Q17
S/L1
S2/L2
S3/L3
C18
C2
C1
CR6
CR7
CR10
R45
R46
CR11
C15
C24
IC6
IC7
IC2
C10
IC3
C22
R52
IC1
IC4
C12
IC5
IC8
IC9
R38
R51
C9
C23
C14
R48
R49
Q16
R50
R54


IC5
2/717 MC1...
IC6
SAME AS IC5
IC7
SAME AS IC5

NOTES: (EXCEPT AS NOTED)

LESS THAN ONE IN µF.
MORE [illegible] µF.

2) RESISTORS
VALUE — IN OHMS
POWER — 1/4 W
TOL — ± 5%

3) R53, RXX VALUE FACTORY SELECTED.

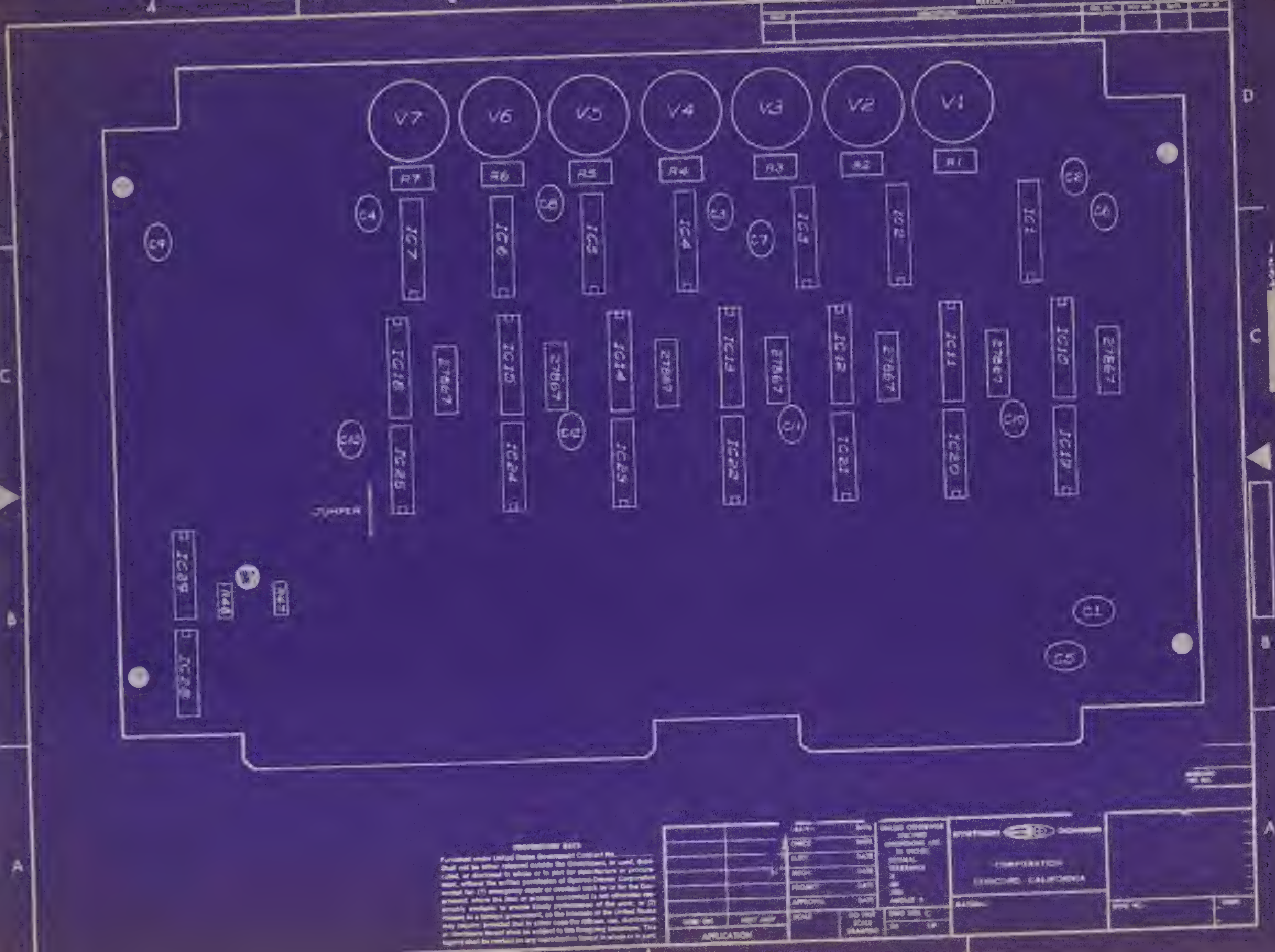
LIST OF MATERIALS

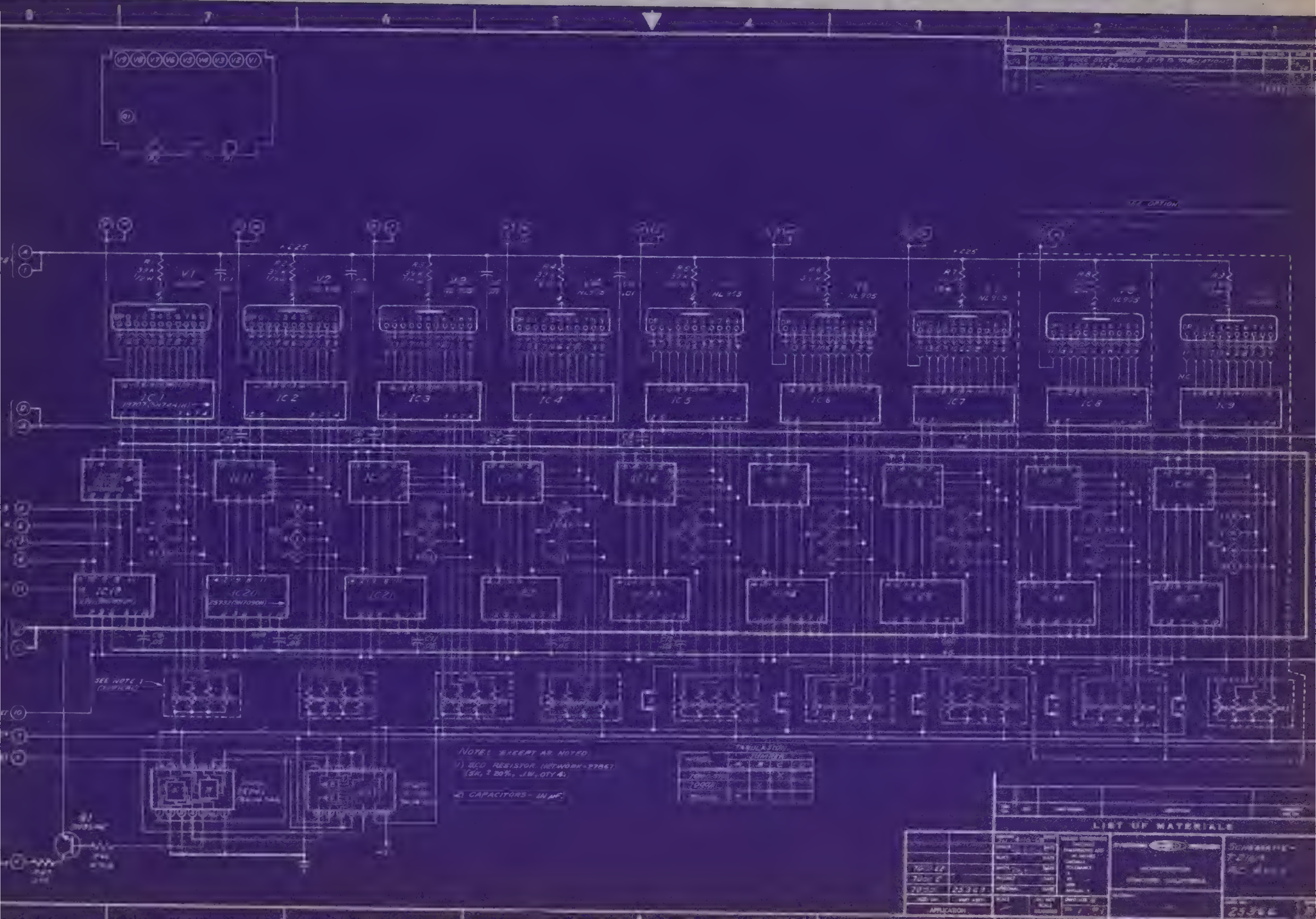
7016	25385
7018	25388
APPLICATION	

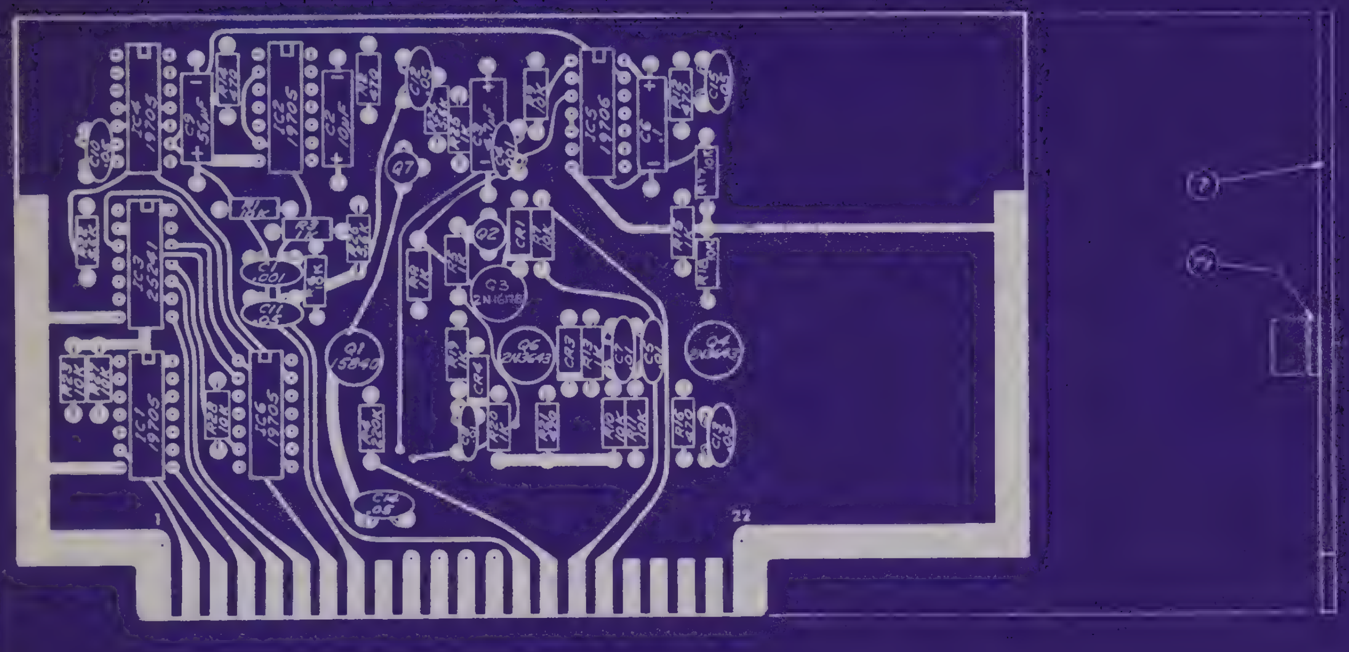
CONCORD, CALIFORNIA

SCHEMATIC
100MHz AMP
DECADE PC ASS

25385


V7
V6
V5
V4
V3
V2
V1
R7
R6
R5
R4
R3
R2
R1
IC7
IC6
IC5
IC4
IC3
IC2
IC1
IC16
IC15
IC14
IC13
IC12
IC11
IC10
27867
IC25
IC24
IC23
IC22
IC21
IC20
IC19
JUMPER
IC29
IC28
R48
R47
C1
C5
C4
C9
C10
C12
APPLICATION
CORPORATION
CONCORD, CALIFORNIA
D
C
B
A


V9 V8 V7 V6 V5 V4 V3 V2 V1
R1 39K 1/2W
R2 39K 1/2W
R3 39K 1/2W
R4 39K
R5 39K
R6 39K
R7
R8
R9
+225
V1
V2
V3
V4 NL 915
V5 NL 915
V6 NL 905
V7 NL 915
V8 NL 905
.01
IC1 25707(SN7441N)
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
NC
IC19
IC20 25732(SN7090N)
IC21
SEE NOTE 1 (TYPICAL)
NOTE: EXCEPT AS NOTED.
1) BCD RESISTOR NETWORK-27867 (5K, ± 20%, 1/4W, QTY 4.)
2) CAPACITORS - IN µF.
TABULATION
LIST OF MATERIALS
SCHEMATIC -
7000 EE
7000 E
7000
23369
APPLICATION
23368


IC1 19705
IC2 19705
IC3 25241
IC4 19705
IC5 19706
IC6 19705
C1 .001
C2 10µF
C6 .1
C9 56µF
C10 .05
C11 .05
C12 .05
C13 .05
C14 .05
C15 .05
Q1 15840
Q2
Q3 2N1613
Q4
Q6
Q7
CR1
CR3
CR4
R28 10K
R22 220K
1
22

NOTE:

1) RESISTORS:
VALUE —— IN OHMS.
POWER —— 1/4 W.
TOL —— 5%.

2) CAPACITORS:
VALUE —— IN µF.

3) TRANSISTORS:
Q2, Q7 —— 2N3646.

4) ALL DIODES 1N4151.

5) SCHEMATIC - 25398.

PARTS LIST 25401
FORMS PART OF THIS DOCUMENT

LIST OF MATERIALS

7015	25698
7014	25660
USED ON	NEXT ASSY
APPLICATION	

DRAWN JAJ 5-2-68
CHECK RB 5-2-68
MECH. RB 8-7-68

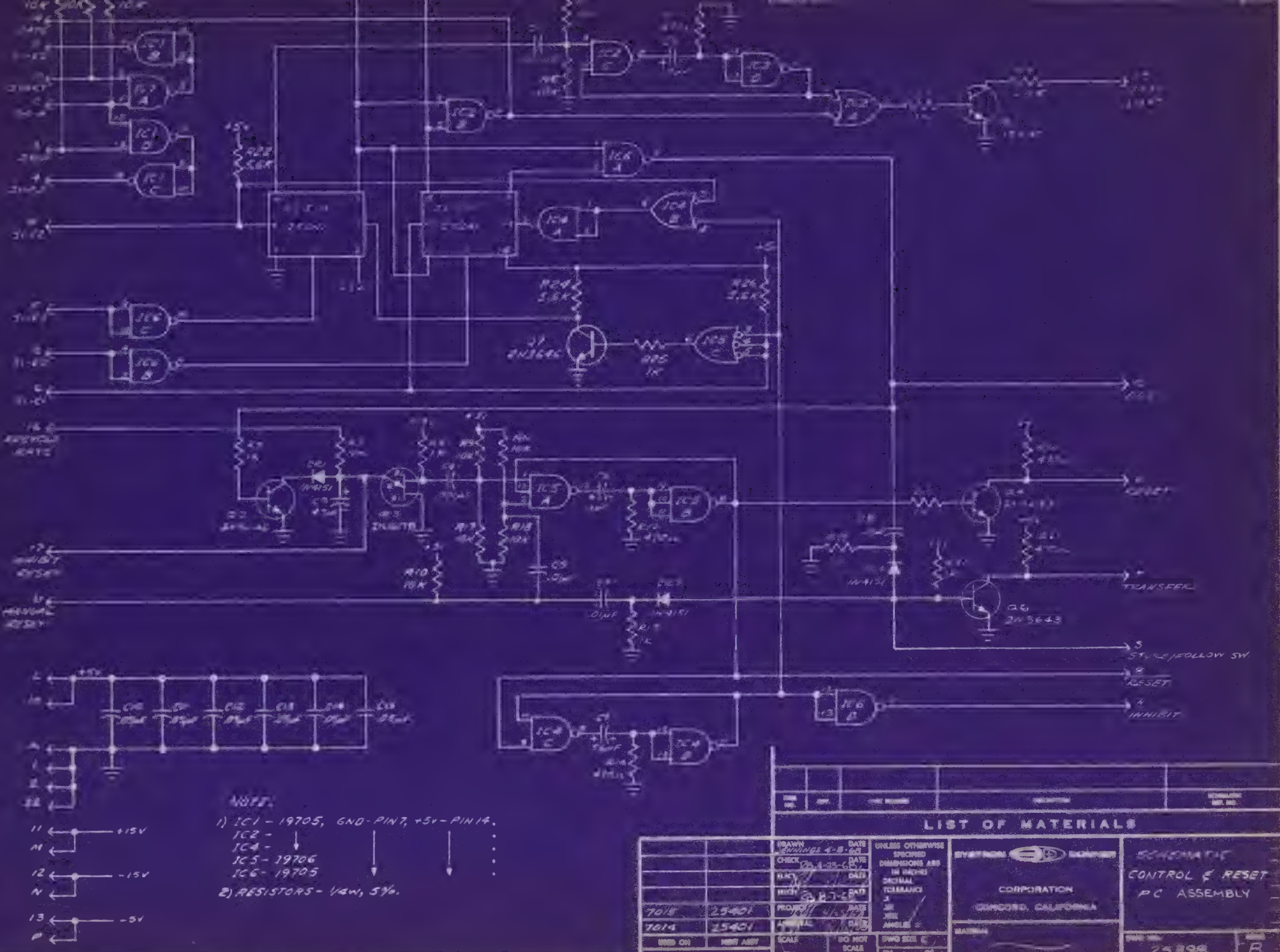
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
DECIMAL TOLERANCE
ANGLES ±

SCALE 2:1
DO NOT SCALE DRAWING
DWG SIZE C
SH 1 OF 1

SYSTRON DONNER
CORPORATION
CONCORD, CALIFORNIA

CONTROL & RESET
PC ASSEMBLY

DWG NO. 25401
B


IC1 A
IC1 B
IC1 C
IC1 D
IC2 A
IC2 B
IC2 C
IC2 D
IC4 A
IC4 B
IC4 C
IC4 D
IC5 A
IC5 B
IC5 C
IC6 A
IC6 B
IC6 C
IC6 D
R22 5.6K
+5v
R24 5.6K
R26 5.6K
Q7 2N3646
R25 1K
R17 10K
R18 10K
R10 10K
C5 .01μf
.01μf
1N4151
R1 1K
+5v
Q6 2N3643
CR1 1N4151
2 RESET
4 TRANSFER
5 STORE/FOLLOW SW
8 RESET
4 INHIBIT
17 INHIBIT RESET
17 MANUAL RESET
16 ZERO ADJUST RATE
+5v
C16
C17
C12
C13
C14
C15
11
M
+15V
12
N
-15V
13
P
-5V

NOTES:

1) IC1 - 19705, GND - PIN 7, +5v - PIN 14.
IC2 - ↓ ↓ ↓
IC4 -
IC5 - 19706
IC6 - 19705

2) RESISTORS - 1/4w, 5%.

LIST OF MATERIALS

		DRAWN Jennings 4-8-6?	DATE
		CHECK	DATE
		ELEC	DATE
		MECH	DATE
7015	25401	PROJECT	DATE
7014	25401	APPROVAL	DATE
USED ON	NEXT ASSY	SCALE	DO NOT SCALE DRAWING
APPLICATION			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DECIMAL TOLERANCE .X .XX .XXX ANGLE ±

DWG SIZE C

SH 1 OF 1

SYSTRON DONNER

CORPORATION

CONCORD, CALIFORNIA

MATERIAL

SCHEMATIC

CONTROL & RESET

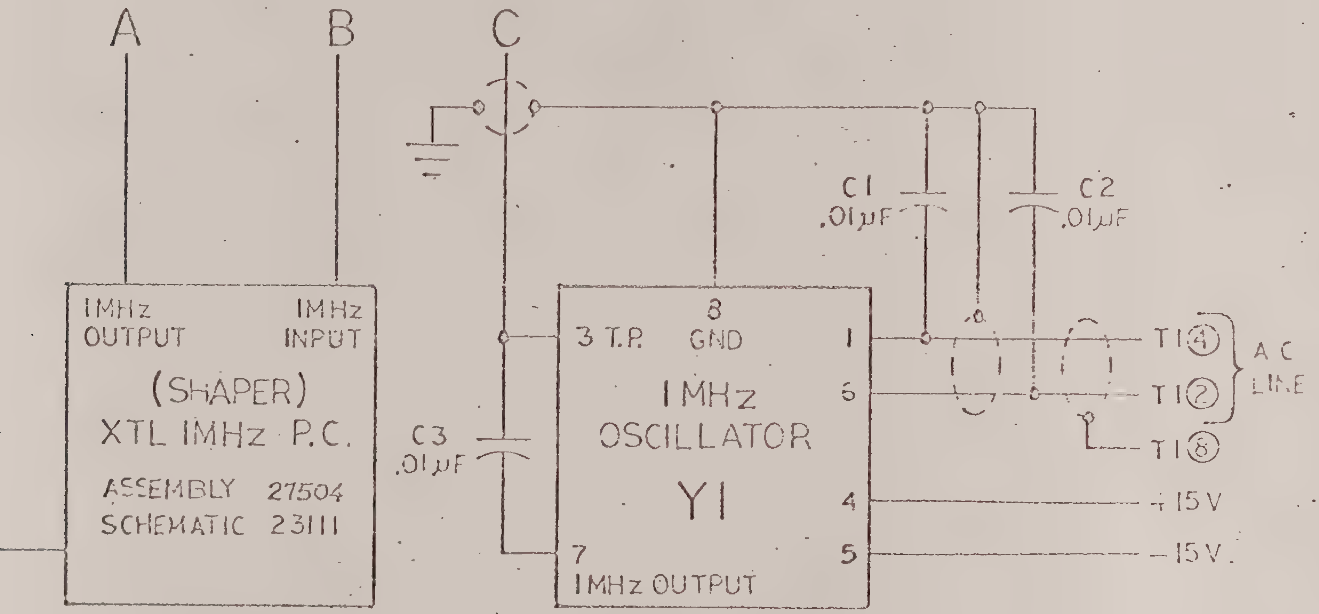
PC ASSEMBLY

DWG NO. 25398

REV B

PROPRIETARY DATA

ɔd under United States Government Contract No. ________
ɔt be either released outside the Government, or used, dupli-
ɔr disclosed in whole or in part for manufacture or procure-
ithout the written permission of Systron-Donner Corporation
for: (1) emergency repair or overhaul work by or for the Gov-
l, where the item or process concerned is not otherwise rea-
available to enable timely performance of the work; or (2)
to a foreign government, as the interests of the United States
uire; provided that in either case the release, use, duplication
osure hereof shall be subject to the foregoing limitations. This
shall be marked on any reproduction hereof in whole or in part.


A
B
C
C1
.01µF
C2
.01µF
C3
.01µF
1MHz OUTPUT
1MHz INPUT
(SHAPER)
XTL 1MHz P.C.
ASSEMBLY 27504
SCHEMATIC 23111
3 T.P.
8 GND
1
6
4
5
7 1MHz OUTPUT
1MHz OSCILLATOR
Y1
T1④
T1②
T1⑧
AC LINE
+15V
−15V

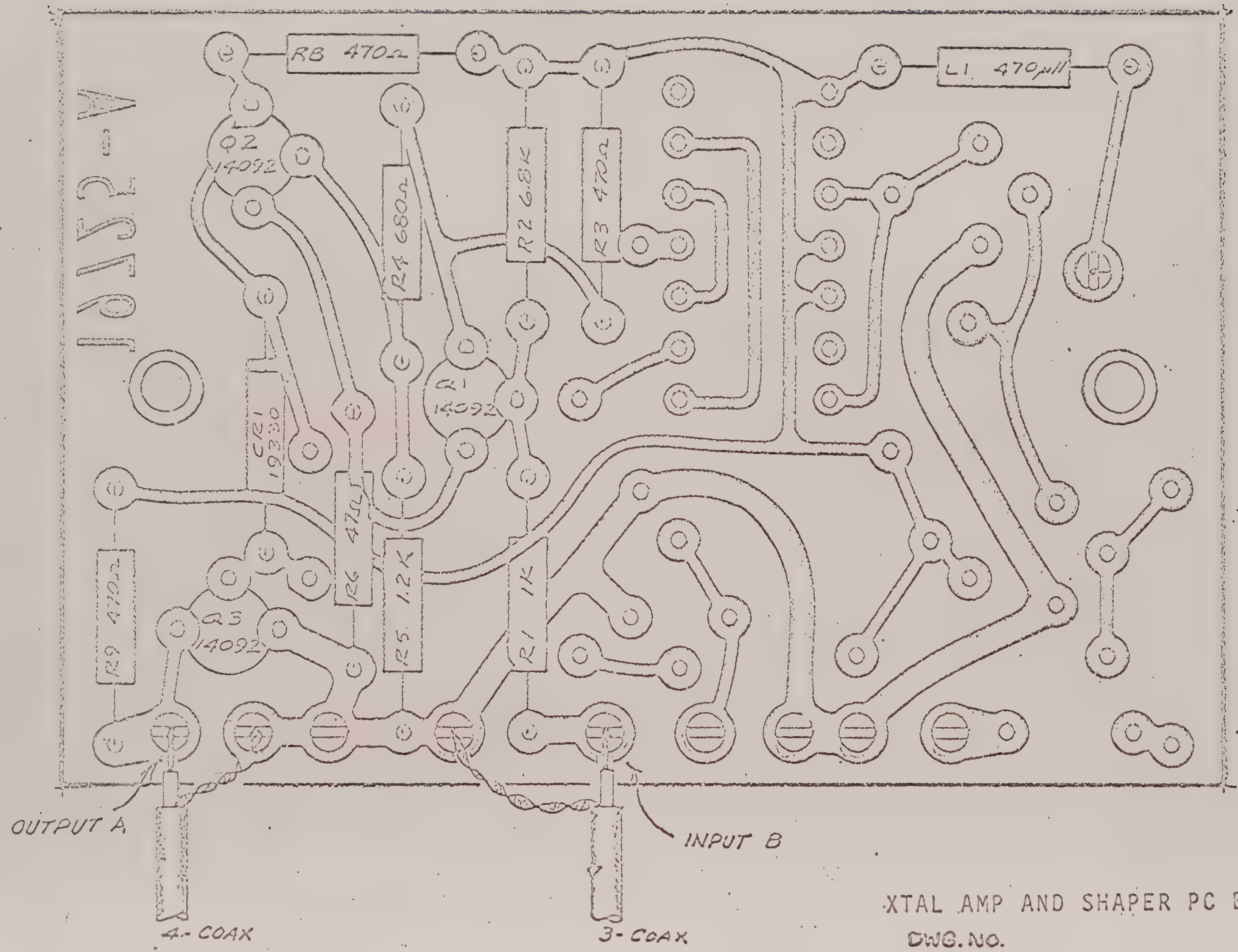
700 XTL
7015
USED ON | NEXT ASSY
APPLICATION

DRAWN | DATE
CHECK | DATE
ELECT | DATE
MECH | DATE
PROJECT | DATE
APPROVAL | DATE
SCALE ~
DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
DECIMAL TOLERANCE
.X
.XX
.XXX ~
ANGLES ±
SIZE A
SH 1 OF 1

SYSTRON DONNER
CORPORATION
CONCORD, CALIFORNIA
MATERIAL ~

SCHEMATIC,
XTL 1MHz
OSC CHASSIS
ASSEMBLY
DWG NO. 27345

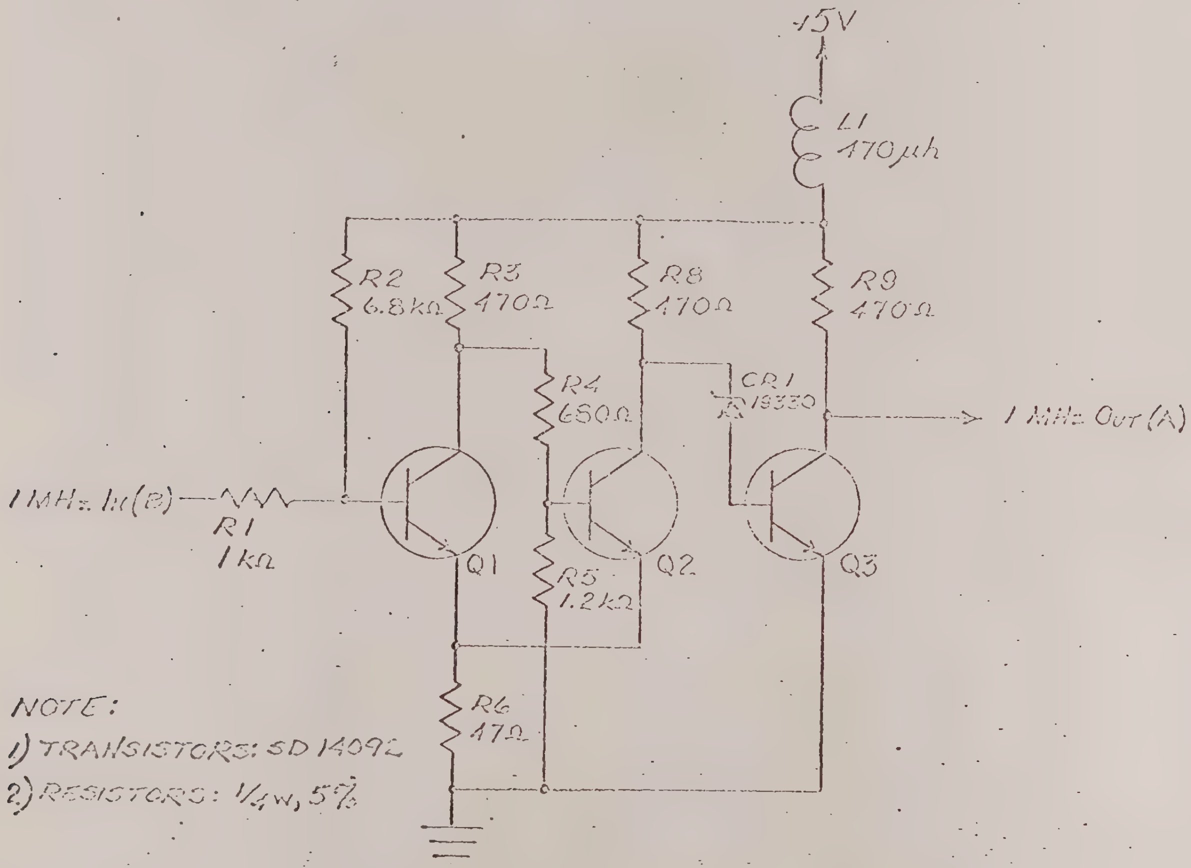

RB 470Ω
L1 470μH
Q2 14092
R4 680Ω
R2 6.8K
R3 470Ω
Q1 14092
CR1 19330
R6 47Ω
R5 1.2K
R1 1K
R9 470Ω
Q3 14092
19725-A
OUTPUT A
INPUT B
4- COAX
3- COAX

XTAL AMP AND SHAPER PC BOARD
DWG. NO.
27504

REVISIONS

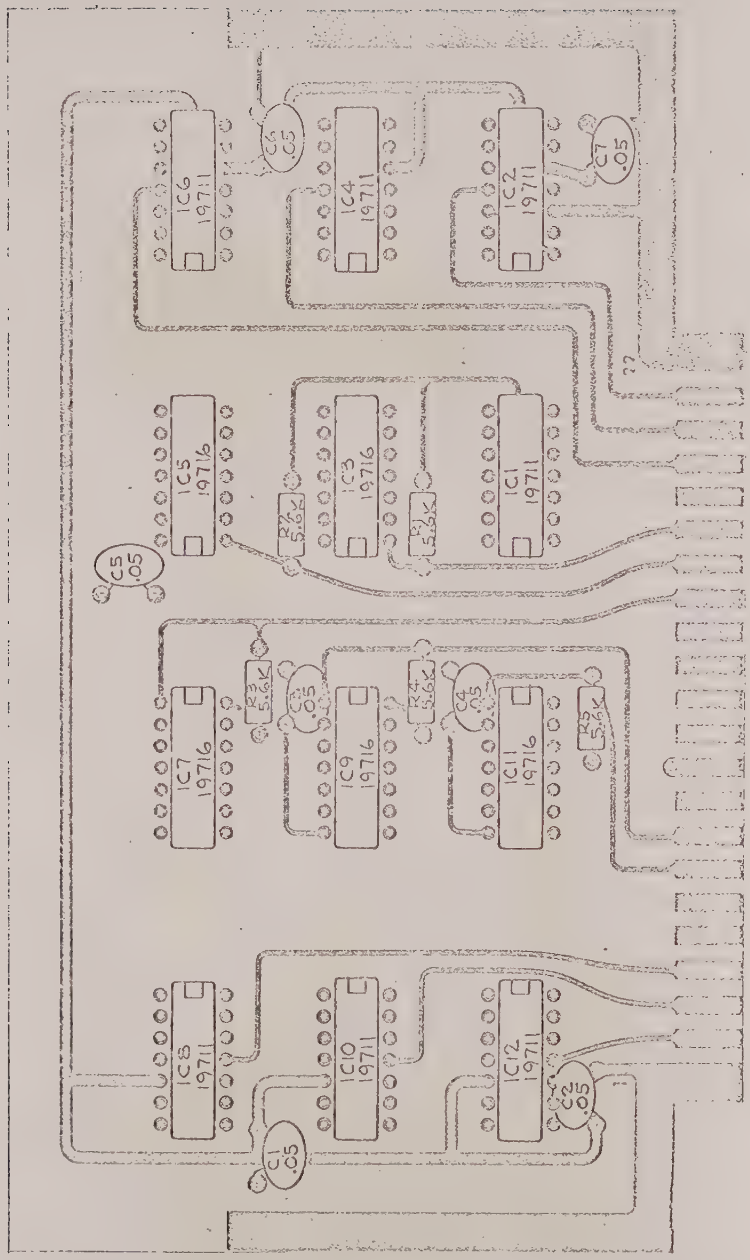
PROPRIETARY DATA

ished under United States Government Contract No.__________
ll not be either released outside the Government, or used, dupli-
d, or disclosed in whole or in part for manufacture or procure-
t, without the written permission of Systron-Donner Corporation
ept for: (1) emergency repair or overhaul work by or for the Gov-
nent, where the item or process concerned is not otherwise rea-
ably available to enable timely performance of the work; or (2)
ase to a foreign government, as the interests of the United States
require; provided that in either case the release, use, duplication
isclosure hereof shall be subject to the foregoing limitations. This
nd shall be marked on any reproduction hereof in whole or in part.



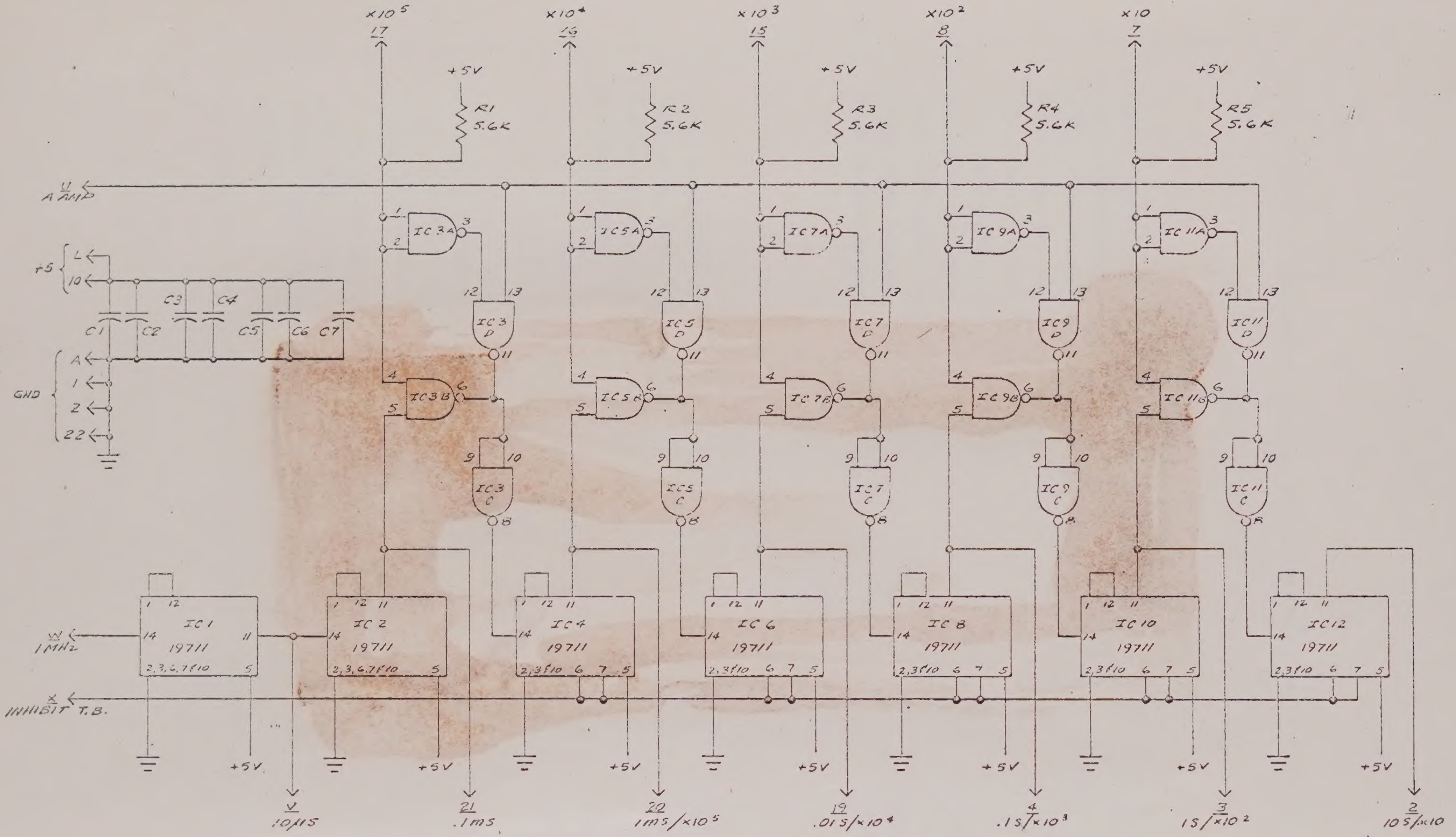
NOTE:
1) TRANSISTORS: SD 14092
2) RESISTORS: 1/4 W, 5%

		DRAWN	DATE	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	SYSTRON DONNER CORPORATION CONCORD, CALIFORNIA	SCHEMATIC - 1MHz PC ASSEMBLY	
		CHECK	DATE	DECIMAL TOLERANCE			
		ELECT.	DATE	X			
		MECH.	DATE	XX			
		PROJECT	DATE	XXX			
		APPROVAL	DATE	ANGLES ±	MATERIAL		
USED ON	NEXT ASSY	SCALE	DO NOT SCALE DRAWING	DWG SIZE A		DWG NO. 23111	IS
APPLICATION				SH OF			



IC6 19711
C6 .05
IC4 19711
IC2 19711
C7 .05
IC5 19716
R2 5.6K
IC3 19716
R1 5.6K
IC1 19711
C5 .05
R3 5.6K
C3 .05
R4 5.6K
C4 .05
R5 5.6K
IC7 19716
IC9 19716
IC11 19716
IC8 19711
IC10 19711
IC12 19711
C2 .05
C1 .05

TIME BASE PC BOARD


x10^5
17
x10^4
16
x10^3
15
x10^2
8
x10
7
+5V
R1 5.6K
R2 5.6K
R3 5.6K
R4 5.6K
R5 5.6K
U
A AMP
+5
L
10
C1
C2
C3
C4
C5
C6
C7
GND
A
1
2
22
IC3A
IC3B
IC3 D
IC3 C
IC5A
IC5B
IC5 D
IC5 C
IC7A
IC7B
IC7 D
IC7 C
IC9A
IC9B
IC9 D
IC9 C
IC11A
IC11B
IC11 D
IC11 C
W
1MHz
IC1 19711
IC2 19711
IC4 19711
IC6 19711
IC8 19711
IC10 19711
IC12 19711
X
INHIBIT T.B.
V
10µs
21
.1ms
22
1ms/x10^5
19
.01s/x10^4
4
.1s/x10^3
3
1s/x10^2
2
10s/x10

NOTE:

1) RESISTORS:
POWER - 1/4W.
TOL - -5%

2) CAPACITORS:
VALUE - .05µF.
VOLTAGE - 12V.

3) IC3, IC5, IC7, IC9 & IC11 ARE 19716
PIN 14 IS + 5.
PIN 7 IS GND.

Schematic 25362

Time Base Logic PC Assembly

DATE DUE			
GAYLORD M-2			PRINTED IN U.S.A.

WARRANTY

Systron-Donner instruments are warranted during a period of one year from date of shipment to original purchaser to be free from defects in material and workmanship. This warranty does not apply to vacuum tubes, except as they are warranted by tube manufacturers. The liability of Seller under this warranty is limited to replacing or repairing any instrument or component thereof which is returned by Buyer at his expense during such period and which has not been subjected to misuse, neglect, improper installations, repair, alteration, or accident. Seller shall have the right of final determination as to the existence and cause of a defect. In no event shall Seller be liable for collateral or consequential damages. This warranty is in lieu of any other warranty, express, implied or statutory, and no agreement extending or modifying it will be binding upon Seller unless in writing and signed by a duly authorized officer.

RECEIVING INSPECTION

Every Systron Donner instrument is carefully inspected and is in perfect working order at the time of shipment. Each instrument should be checked as soon as received. If the unit is damaged in any way or fails to operate, a claim should immediately be filed with the transportation company.

REPAIRS

Whenever a Systron-Donner instrument requires service, the nearest Systron-Donner representative should be contacted; all representatives will provide immediate service or arrange factory returns when necessary.

Please specify both model and serial number in all correspondence concerning Systron-Donner instruments. Address all inquiries on operation or applications to your nearest sales representative or Sales Manager, Instruments, Systron-Donner Corporation, 888 Galindo Street, Concord, California.

www.manualsplus.com
1025384